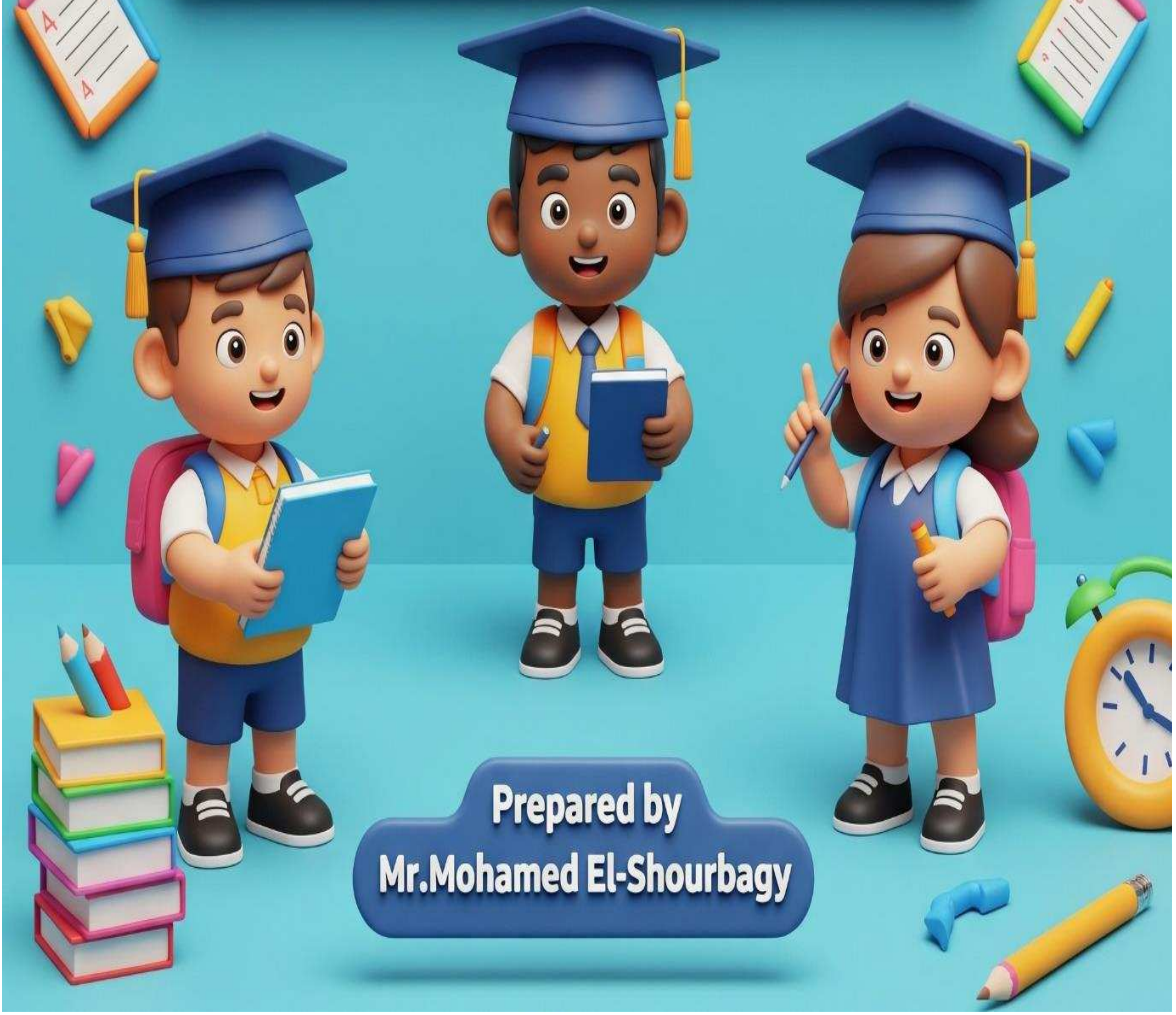
Simplest Maths Booklets

Grade 6 - First Term 2026

Explaining and Exercises



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CONTENTS

Unit 1

Divisibility, Factors, and Multiples

Concept 1.1: Divisibility, GCF, and LCM

Lesson 1: Divisibility

Lesson 2: Factorizing a Number to Its Prime Factors

Lesson 3: Writing Expressions Using the GCF

Lesson 4: Analyzing Least Common Multiples

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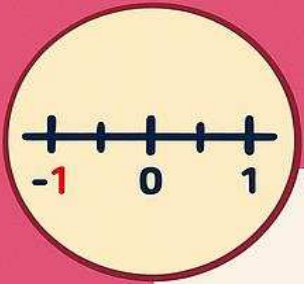
Unit 2 Rational Numbers

Concept 2.1: Explore the Number Line



Lesson 1: Using a Number Line to Describe Data

Lesson 2: Using a Number Line and Symbols to Compare Number

Concept 2.2: Investigate Rational Numbers

Lesson 3: Analyzing Rational Numbers by Using Models

Comparing and Ordering Rational Numbers

Concept 2.3: Interpret and Use Absolute Value

Lesson 5: Exploring Absolute Valu

Lesson 6: Comparing Absolute Values

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Unit 3 Algebraic Expressions

Concept 3.1: Use and Analyze Expressions

Lessons 1: Creating Mathematical Expressions

Lessons 2: Analyzing Mathematical Expressions

Lesson 3: Writing Algebraic Expressions

Concept 3.2: Algebraic Expressions and Exponents

Lesson 4: Ordering of Operations and Exponents

Lessons 5-7: Evauting Algebraic Expressions

Applications on Algebraic Expressions

Determining Equivalent Algebraic Expressions

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UNIT 4 Equations and Inequalities

Concept 4.1: Write and Solve Equations and Inequalities

Lesson 1: Solving Algebraic Equations

Lessons 2&3: Exploring Inequalities

Solving Inequalities

UNIT 5 Dependent and Independent Variables

Concept 5.1: Explore Relationship Betwen Variables

Lesson 1 & 2: The Relationship Between Dependent and Independarables

Lesson 3: Analyzing the Relationship Between Dependent and Independent Variables

Lesson 4: Graph Representation

UNIT 6 Data Distributions

Concept 6.1: Applications on Collecting and Representing Data

Lesson 1: Data and Statistical Questions Exploring the Histogram

Lessons 2 & 3: Exploring Data Usinggrams

Lesson 4: Exploring Box Plot

5: Aplications on Data Representations

UNIT 7 Measures of Central Tendency and Spread

Concept 7.1: Exploring Measures

Lessons 1 & 2: Exploring Balance of Data Sels

Interpreting Arithmetic Mean

Lesson 3: Exploring Median,and Outliers

Lesson 4: Exploring the Range

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Unit 1 Lesson 1

The divisibility

Explaining

(1) The meaning of divisibility

We know that : 10 ÷ 3 = 3 and the remainder = 1

So, we say that : 10 is not divisible by 3

We know that : 10 ÷ 5 = 2 and the remainder = 0

So, we say that : 10 is divisible by 5

Generally

Any number is divisible by another if the remainder of the division is zero.

Example

Division	Quotient	Remainder	Divisibility
14 ÷ 2	7	0	14 is divisible by 2
17 ÷ 3	5	2	17 is not divisible by 3
25 ÷ 5	5	0	25 is divisible by 5
37 ÷ 6	6	1	37 is not divisible by 6

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(2) Multiples and divisibility

We know that :

15 is a multiple of both of 3 and 5 because :

$3 \times 5 = 15$

$15 \div 3 = 5$ and the remainder = 0 Therefore : 15 is divisible by 3	$15 \div 5 = 3$ and the remainder = 0 Therefore : 15 is divisible by 5

So , 15 (a multiple of the number 3) is divisible by 3

and also 15 (a multiple of the number 5) is divisible by 5

Generally

All the multiples of a number are divisible by this number.

Example

- $2 \times 6 = 12$, therefore 12 is a multiple of each of the two numbers 2 and 6
  So , 12 is divisible by each of the two numbers 2 and 6
- 9 is not a multiple of 2
  So , 9 not divisible by 2 [Note : $9 \div 2 = 4$ and the remainder = 1]

Remarks

A whole number is divisible by	If
2	• its Ones digit is 0 , 2 , 4 , 6 or 8 (the whole number is even.)
3	• the sum of its digits is divisible by 3
5	• its Ones digit is 0 or 5
10	• its Ones digit is 0

Important Notes:

The relationship between divisibility and (factors & multiples):

Ex. The factors of 12 are 1, 2, 3, 4, 6 and 12.

So, the number 12 is divisible by any of these factors,

Ex. The multiples of 5 are 0, 5, 10, 15, 20, ...

So, any of these multiples are divisible by 5,

Therefore, factors and multiples can be used to determine numbers that are divisible without remainder.

Ex. 25 is divisible by 5 because:
25 is a multiple of 5 or 5 is a factor of 25.

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Exercises on lesson 1

1 Complete the following table:

	Division	Quotient	Remainder	Divisible/ Not Divisible
Ex.	45 ÷ 5	9	0	45 is divisible by 5
Ex.	25 ÷ 4	6	1	25 is not divisible by 4
a	60 ÷ 7	....	....	60 is .... by 7
b	35 ÷ 4	....	....	35 is .... by 4
c	28 ÷ 7	....	....	28 is .... by 7
d	120 ÷ 4	....	....	120 is .... by 4
e	29 ÷ 5	....	....	29 is .... by 5
f	18 ÷ 6	....	....	18 is .... by 6

2 Circle the number which is divisible by 2:

30	65	97	54	258
45	212	127	641	654
26	151	368	6,530	4,261

3 Circle the number which is divisible by 3:

45	36	28	456	2,005
154	368	554	1,002	12,748
558	652	100	58	10,002

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4 Circle the numbers which are divisible by 5:

45	36	250	156	558
154	830	945	630	354
101	2,005	12,748	55,551	2,003

5 Use the following numbers to complete:

335   342   531   250   315   702   600

a) The numbers which are divisible by 2: ....

b) The numbers which are divisible by 3: ....

c) The numbers which are divisible by 5: ....

d) The numbers which are divisible by 6: ....

e) The numbers which are divisible by 10: ....

6 Complete the following table using (✓) or (✗):

	Number	Divisible by...					
		2	3	4	5	6	10
Ex.	45	✗	✓	✗	✓	✗	✗
a	32	....	....	....	....	....	....
b	24	....	....	....	....	....	....
c	30	....	....	....	....	....	....
d	126	....	....	....	....	....	....
e	130	....	....	....	....	....	....
f	120	....	....	....	....	....	....
g	456	....	....	....	....	....	....

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7 Choose the correct answer between brackets :

(a) The number is said to be divisible by 3 if the sum of its digits is divisible by .... (2 or 3 or 5 or 7)

(b) 42 is divisible by .... (2 or 5 or 4 or 8)

(c) 32 is not divisible by .... (4 or 8 or 6 or 2)

(d) 75 is divisible by .... (2 or 4 or 5 or 6)

(e) 1 401 is divisible by .... (2 or 3 or 5 or 10)

(f) 590 is not divisible by .... (2 or 3 or 5 or 10)

(g) 430 is divisible by .... (3 only or 5 only or 2 only or both 2 and 5)

(h) 60 is divisible by ....

(3 only or 2 and 3 only or 2 and 5 only or 2 , 3 and 5)

(i) The number .... is divisible by both 3 and 5

(1 115 or 4 125 or 3 333 or 6 665)

(j) The number .... is divisible by 2 , 3 and 5

(200 or 190 or 750 or 636)

(k) (511 + ...) is divisible by 5 (1 or 3 or 6 or 9)

CHALLENGE 1

- I am an even number.
- I am divisible by 3.
- One of my factors is 4.
- I am not divisible by 5.
- Who am I? ______

Choose

A 324	B 183	C 657	D 540
E 245	F 476	G 906	H 751

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Quiz

10

Choose the correct answer:

1	.... is a common multiple for all counting numbers A) 5 B) 0 C) 1 D) 10
2	26 , 4 , 2 and 20 are multiples of the number .... A) 2 B) 7 C) 9 D) 13
3	The number 235 is divisible by .... A) 3 B) 5 C) 6 D) 10
4	The number .... is divisible by 2 , 3 A) 10 B) 18 C) 13 D) 15
5	All even numbers divisible by .... A) 2 B) 3 C) 4 D) 5
6	The number 1278 is divisible by .... A) 3 B) 5 C) 7 D) 10
7	The common multiple of all numbers is .... A) 10 B) 2 C) 5 D) 0
8	The number 57 is divisible by .... A) 5 B) 2 C) 3 D) 11
9	The number .... is divisible by 3 A) 83 B) 37 C) 87 D) 98
10	.... is a multiple of the number 5 A) 23 B) 40 C) 51 D) 8

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Unit 1 Lesson 2

Factorizing a Number to its Prime Factors

Explaining

Remember

A **Prime number** is a whole number that has exactly two different factors, 1 and itself.

Examples for prime numbers :
2 , 3 , 5 , 7 , 11 , 13 , 17

A **Composite number** is a whole number that has more than two factors.

Examples for composite numbers :
4 , 6 , 9 , 12 , 25 , 30

- All prime numbers are odd, except 2.
- The smallest prime number is 2.
- The only even prime number is 2.
- The smallest odd prime number is 3.
- 1 is neither a prime number nor a composite number.
- Any number is a factor and a multiple of itself, except zero.

Prime factorization

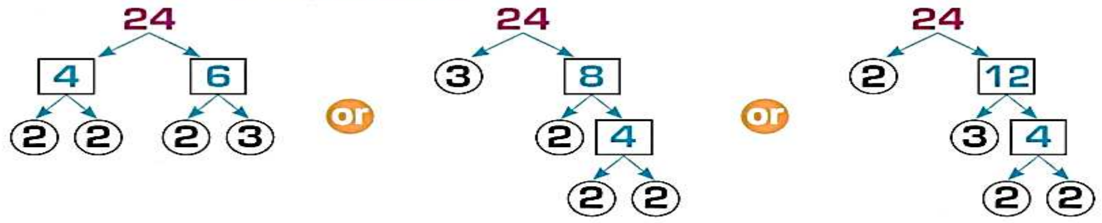
Means writing the composite number as the product of prime numbers.

Ex. Factorize 24 into its prime factors:

1. Choose two numbers whose product is 24 (1 should not be used).
2. Circle the prime numbers and leave them, then continue factorizing the composite numbers.
3. Stop when all numbers become prime numbers.

Note that: All the following are true, and we get the same result:

24 = 2 X 2 X 2 X 3



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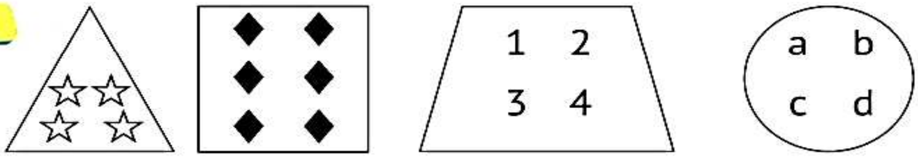
Venn Diagram

Is a closed shape contains elements (things) in it.

For example:

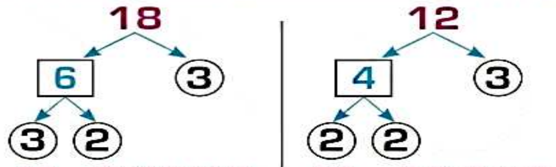


Find the GCF and LCM Using a Venn Diagram

We can find the GCF and LCM of two numbers using a Venn diagram by following these steps:

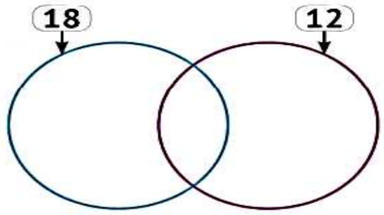
Ex. **Find the GCF and LCM for 18 and 12 using a Venn diagram:**

1 Factorize the two numbers into their prime factors using the factors tree.

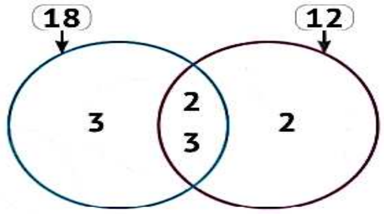


18 = 2 X 3 X 3 | 12 = 2 X 2 X 3

2 Draw two intersecting circles, each circle contains the prime factors of one of the two numbers.

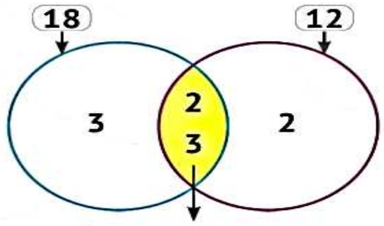


3 Place the prime factors for each number in its circle so that the common prime factors of the two numbers are in the common part between the two circles.



4 The greatest common factor of the two numbers is the product of factors presented in the common part between the two circles.

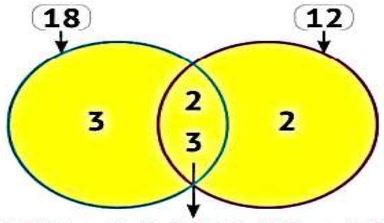
GCF = 2 X 3 = 6



GCF = 2 X 3 = 6

5 The least common multiple of the two numbers is the product of all the factors in the two circles.

LCM = 2 X 3 X 2 X 3 = 36



LCM = 2 X 3 X 2 X 3 = 36

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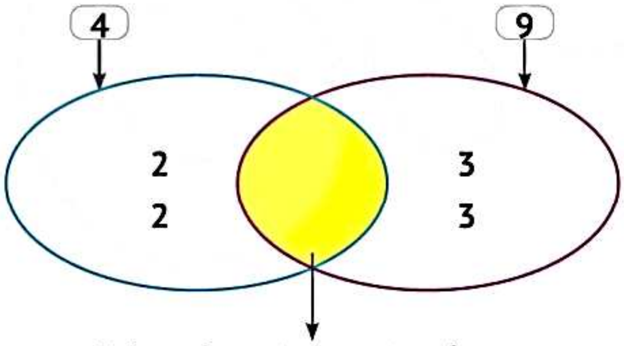
Relatively Prime Numbers

They are numbers whose only common factor is 1.

So, they are prime numbers with respect to each other.

For example: 4 and 9 are composite numbers.

4 = 2 X 2 , 9 = 3 X 3



When there is no prime factors in the common part, then

GCF = 1

- The greatest common factor of 4 and 9 is 1.
- Therefore 4 is a prime number with respect to 9.
- 9 is a prime number with respect to 4.
- 4 and 9 are relatively prime numbers.

Important Note:

- The lowest common multiple of the relatively prime numbers is **their product.**

For example: The common multiple of 4 and 9 is **4 X 9 = 36.**

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Exercises on lesson 2

1 Factorize each number into its prime factors using the factors tree:

ⓐ 16

16

16 = ...

ⓑ 20

20

20 = ...

ⓒ 36

36

36 = ...

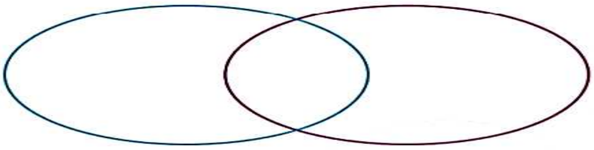
ⓓ 48

48

48 = ...

2 Find the GCF and LCM of the following numbers:

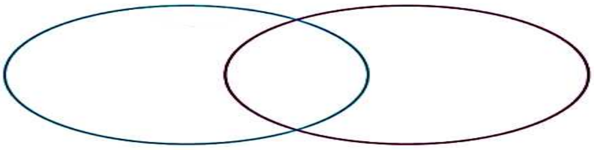
ⓐ 16 and 20



16 | 20

- GCF = ...
- LCM = ...
- 16 = ...
- 20 = ...

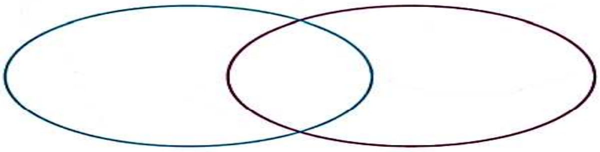
ⓑ 24 and 36



24 | 36

- GCF = ...
- LCM = ...
- 24 = ...
- 36 = ...

ⓒ 16 and 15



16 | 15

- GCF = ...
- LCM = ...
- 16 = ...
- 15 = ...

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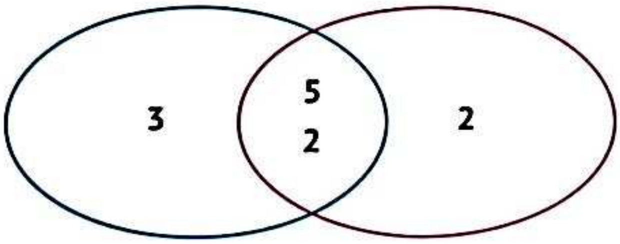
3 Complete the following table:

	Numbers	Prime Factors	GCF	LCM	Relatively Prime Numbers (Yes or No?)
a	12 , 15	12 = ... 15 = ...	....	....	....
b	9 , 8	9 = ... 8 = ...	....	....	....
c	15 , 4	15 = ... 4 = ...	....	....	....
d	6 , 8	6 = ... 8 = ...	....	....	....

4 Using the following Venn diagram, complete:



a. The two numbers represented in the Venn diagram are .... and ....

b. The common prime factors of the two numbers are ....

c. The GCF for the two numbers is ....

d. The LCM for the two numbers is ....

e. Are the two numbers relatively prime numbers? ....

(Yes or No?)

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Quiz

10

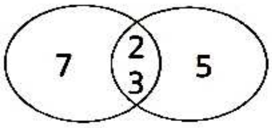
Choose the correct answer.

1. The G.C.F of 10 and 15 is ———
   A. 10 B. 15
   C. 5 D. 30

2. L.C.M of 5 and 7 is ———
   A. 12 B. 35
   C. 1 D. 0

3. L.C.M of 8 and 18 = ———
   A. 8 B. 18
   C. 24 D. 72

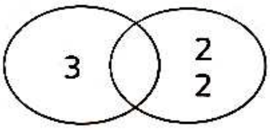
4. From the opposite Venn diagram
   G.C.F = ———
   A. 6 B. 210
   C. 42 D. 30



5. ——— is a multiple of any number.
   A. 0 B. 1
   C. 2 D. 3

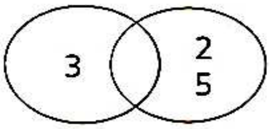
6. The common factor of all numbers is ———
   A. 0 B. 1 C. 2 D. 3

7. From the opposite Venn diagram G.C.F = ———



   A. 0 B. 4 C. 12 D. 1

8. From the opposite Venn diagram L.C.M = ———



   A. 10 B. 1 C. 0 D. 30

9. Which of the following are relatively prime numbers ?
   A. 2 and 6 B. 15 and 30 C. 35 and 16 D. 12 and 18

10. Which of the following is not a prime number ?
   A. 2 B. 5 C. 7 D. 9

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Unit 1 Lesson 3

Writing Expressions Using the G.C.F

Explaining

Remember

- The Distributive Property states that multiplying a number by the sum of two addends is the same as multiplying that number by each addend individually and then adding those products.

Ex. 7 X (3 + 9) = (7 X 3) + (7 X 9)

Example 1

Use the distributive property and G.C.F to write the expression of the following addition problems.

a. 7 + 56

b. 8 + 10

c. 15 + 45

d. 20 + 60

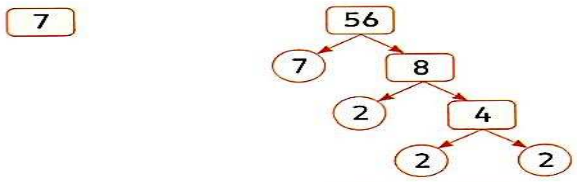
Solution

a. 7 = 7

56 = 7 × 2 × 2 × 2

G.C.F = 7

Expression : 7 + 56 = 7 (1 + 8)



b. 8 = 2 × 2 × 2

10 = 2 × 5

G.C.F = 2

Expression : 8 + 10 = 2 (4 + 5)

c. 15 = 3 × 5

45 = 3 × 5 × 3

G.C.F = 3 × 5 = 15

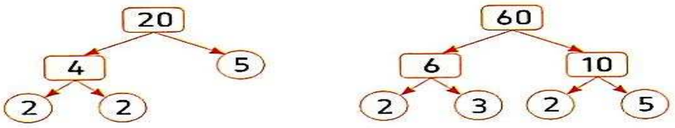
Expression : 15 + 45 = 15 (1 + 3)

d. 20 = 2 × 2 × 5

60 = 2 × 2 × 5 × 3

G.C.F = 2 × 2 × 5 = 20

Expression : 20 + 60 = 20 (1 + 3)



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Exercises on lesson 3

1 Complete the following:

ⓐ 5 X (3 + 6) = (.................. X ....) + (.................. X ....)

ⓑ .... X (.................. + ...) = (7 X 2) + (7 X 4)

ⓒ 8 X (.................. + ...) = (.................. X 9) + (.................. X 2)

ⓓ .... X (4 + 6) = (9 X ....) + (9 X ....)

2 Malak cooked 30 dishes of Um Ali and 48 pieces of baklava for her family. She wants to divide the desserts into boxes so that each person gets the same number of the two desserts.
Write a numerical expression representing the largest number of boxes that she can prepare.

30 = ...
48 = ...

GCF = ...

30

48

ⓐ The largest number of boxes (GCF) is ....

ⓑ Number of Umm Ali dishes in each box: ....

ⓒ Number of baklava pieces in each box: ....

ⓓ The numerical expression: ....

3 Ahmed wants to grow 24 jasmine plants and 16 phil plants in his garden. Ahmed wants to plant these plants in basins so that each basin contains the same number of the two types of plants.
Write a numerical expression that represents the largest number of basins he can plant.

.... = ...
.... = ...

.... = ...

24

16

The numerical expression: ....

....

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Quiz

—
10

1 Complete the following:

ⓐ 5 X (7 + 2) = (5 X ....) + (.................... X 2)

ⓑ 2 X (.................... + ...) = (.................... X 4) + (.................... X 6)

ⓒ The GCF for 9 and 6 is ....

ⓓ The GCF of all numbers is ....

ⓔ 5 x (.................... + ...) = 30 + 40

2 Answer the following:

ⓐ Sama has 12 red pens and 15 blue pens. What is the greatest number of groups can Sama divide the pens into so that all groups contain the same number of both colors?

...... = ...

...... = ...

.... = ...

....

....

....

ⓑ Marwa divided 12 oranges and 8 candies into bags so that the bags contained the same number of oranges and the same number of candies. Write a numerical expression for this situation.

....

....

....

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Unit 1 Lesson 4

Analyzing Least Common Multiples

Explaining

Remember

For Adding and Subtracting Fractions with Unlike Denominators By Using the LCM

Solution steps:

1. Find the LCM for the denominators.
2. Replace these fractions with **equivalent fractions** with a like denominator.
3. **Add** or **subtract**, then putting the answer in its simplest form if possible.

For example:

ⓐ **Add:** $3\frac{3}{8} + 9\frac{1}{6}$

Note that:

1. The LCM for 8 and 6 is 24.
2. $3\frac{3}{8} = 3\frac{9}{24}$ (×3) , $9\frac{1}{6} = 9\frac{4}{24}$ (×4)
3. $3\frac{3}{8} + 9\frac{1}{6} = 3\frac{9}{24} + 9\frac{4}{24} = 12\frac{13}{24}$

ⓑ **Subtract:** $9\frac{4}{9} - 6\frac{1}{3}$

Note that:

1. The LCM for 9 and 3 is 9.
2. $9\frac{4}{9} = 9\frac{4}{9}$, $6\frac{1}{3} = 6\frac{3}{9}$ (×3)
3. $9\frac{4}{9} - 6\frac{1}{3} = 9\frac{4}{9} - 6\frac{3}{9} = 3\frac{1}{9}$

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Learn

Analyzing the Least Common Multiple

Ex. Ola made 4 trays of basbousa of the same size and cut each tray of basbousa in a different way. After the end of the party, she noticed that there was left over basbousa in each tray, as follows:

$\frac{1}{3}$ of the first tray, $\frac{1}{6}$ of the second tray, $\frac{5}{12}$ of the third tray, $\frac{1}{4}$ of the last tray.

What is the total amount of basbousa left?

$$\frac{1}{3} + \frac{1}{6} + \frac{5}{12} + \frac{1}{4} = \frac{4}{12} + \frac{2}{12} + \frac{5}{12} + \frac{3}{12} = \frac{14}{12} = 1\frac{2}{12} = 1\frac{1}{6} \text{ trays}$$

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Exercises on lesson 4

1 Find the result: (In the simplest form)

ⓐ $\frac{3}{4} + \frac{5}{12}$ = ... + ... = ...

ⓑ $\frac{7}{9} - \frac{1}{3}$ = ... – .... = ...

ⓒ $2\frac{3}{8} + 1\frac{5}{6}$ = ... + ... = ...

ⓓ $5\frac{8}{9} - 3\frac{1}{2}$ = ... – .... = ...

ⓔ $8\frac{1}{5} + 2\frac{1}{3}$ = ... + ... = ...

ⓕ $6\frac{2}{3} - 2\frac{1}{4}$ = ... – .... = ...

2 Answer the following:

ⓐ Maher spent $2\frac{3}{4}$ hours studying Arabic, $1\frac{1}{2}$ hours studying mathematics, and $1\frac{1}{5}$ hours studying science.

How many hours did Maher spend studying all subjects?

....

....

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(b) Galal bought a pen for $5\frac{1}{2}$ pounds, a ruler for $3\frac{3}{4}$ pounds, and an eraser for 2 pounds. How much money did Galal pay to buy these supplies?

....

....

(c) Karim had $25\frac{1}{2}$ pounds, and he bought a booklet for $16\frac{1}{4}$ pounds. How much money is left with Karim?

....

....

(d) Ahmed runs for $4\frac{1}{2}$ hours a day, and Heba runs for $3\frac{1}{4}$ hours a day. What is the difference between the time they both run?

....

....

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Quiz

$\frac{\quad}{10}$

1 Complete the following:

ⓐ $5\frac{1}{6} + 3\frac{1}{3} =$ ....

ⓑ $9\frac{1}{2} - 2\frac{1}{4} =$ ....

ⓒ $7\frac{3}{4} -$ .... $= 3\frac{2}{5}$

ⓓ .... $- 3\frac{4}{5} = 7\frac{1}{3}$

2 Answer the following:

ⓐ Attia bought $3\frac{1}{2}$ kg of oranges and $4\frac{1}{4}$ kg of bananas.

What is the total mass of fruit that Attia bought?

....

....

ⓑ Hana had 12 meters of fabric, of which she used $3\frac{1}{2}$ meters to make a dress. How many meters of fabric does she have left?

....

....

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Unit 2

Lessons 1 and 2

Using a Number Line to Describe Data
Using a Number Line and Symbols to Compare Numbers

Explaining

Sets of Numbers

- You have studied some sets of numbers, as follows:

The Set of Counting Numbers: 1 , 2 , 3 , 4 , 5 , 6 , 7 , ...

The Set of Odd Numbers: 1 , 3 , 5 , 7 , 9 , 11 , 13 , ...

The Set of Even Numbers: 0 , 2 , 4 , 6 , 8 , 10 , 12 , ...

Now you will study:

The Set of Natural Numbers:

- They are a set of counting numbers in addition to zero.

0 , 1 , 2 , 3 , 4 , 5 , 6 , 7 , ...

The Set of Integers:

- They are numbers that do not contain decimals or fractional parts.

Integers

Negative numbers
They are numbers less than zero, preceded by a (–) sign.
Ex. –5, –58, –212, ...

Zero
"0" is neither positive nor negative.

Positive numbers
They are numbers greater than zero and are written without a sign.
Ex. 25, 2, 157, ...

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Remarks

1. The integer zero is neither positive nor negative.
2. The non-negative integers are : 0 , 1 , 2 , 3 , 4 , ...
3. The non-positive integers are : 0 , – 1 , – 2 , – 3 , – 4 , ...

Keywords

Negative
- To the left
- Backward
- Down
- Loss
- Below sea level
- Sub zero
- Withdraw
- Deep

Positive
- To the right
- Foreword
- Up
- Profit/Gain
- Above sea level
- Over zero
- Deposit
- High

Example 1

Which is an integer ?

a. – 0.5 b. – 5 c. 5.5

d. $5\frac{4}{5}$ e. $\frac{7}{7}$ f. $\frac{12}{3}$

Note that
Fractions and decimals which is not whole number is not integers

Solution

a. not integer b. integer c. not integer

d. not integer e. integer $(\frac{7}{7} = 1)$ f. integer $(\frac{12}{3} = 4)$

Example 2

Write an integer to represent each of the following situations.

a. A profit of 25 L.E. b. A loss of 3 L.E.

c. 10 degrees below 0 d. An increase of 75 L.E.

e. 6 m above sea level. f. 19 m below ground.

g. A building is 12 m high. h. 4 steps backward.

Solution

a. 25 b. – 3 c. – 10 d. 75

e. 6 f. – 19 g. 12 h. – 4

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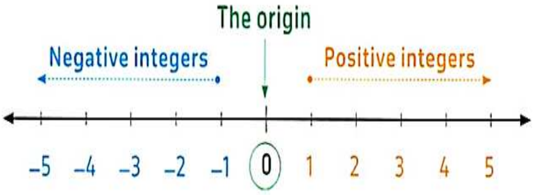
Representing integers on the number line

you can represent integers on horizontal or vertical number line.

Every integer can be represented by one point on the number line as follows :

Horizontal number line



From the number line above, notice that :

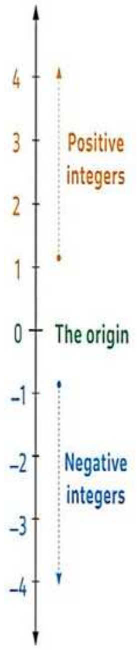
- The negative integers are to the left of zero.
- The point that represents 0 is called "the origin".
- The positive integers are to the right of zero.

• The integers are **infinite numbers,** so it extends to infinity right to zero and left to zero.

Vertical number line

From the opposite number line, notice that :

- The negative integers are below zero.
- The positive integers are above zero

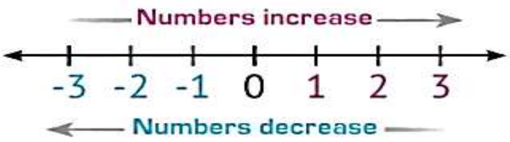


Comparing Integers Using a Number Line

- A number line can be used to compare integers for any two different numbers on the number line:

Horizontal Number Line

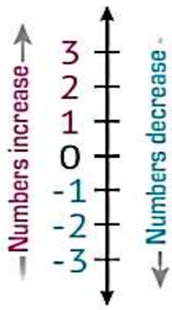
The greater number is to the right of the other number.



The smaller number is to the left of the other number.

Vertical Number Line

The greater number is above the other number.



The smaller number is below the other number.

So that ... < –5 < –4 < –3 < –2 < –1 < 0 < 1 < 2 < 3 < 4 < 5 < ...

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Important Notes:

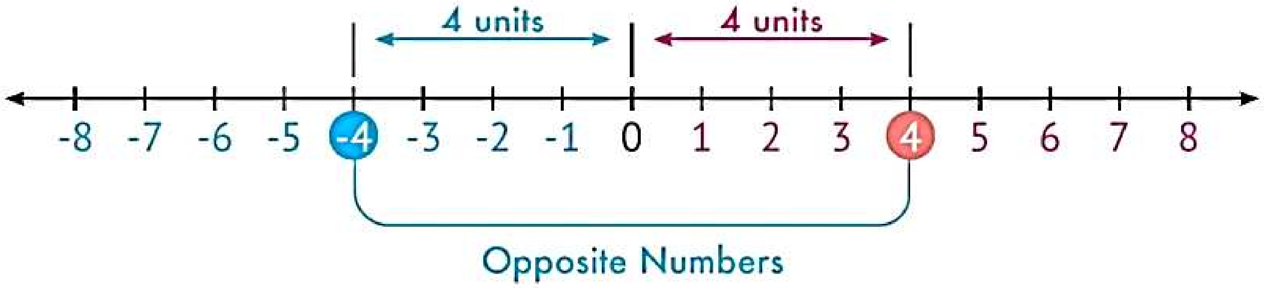
- The numbers **increase** from left to right and from bottom to top.
- The numbers **decrease** from right to left and from top to bottom.
- Any positive number is **greater than** any negative number.
- Zero is **less than** any positive number and **greater than** any negative number.

Negative Integers < 0 < Positive Integers

- The **smallest positive number** is 1, and the **largest positive number** cannot be specified.
- The **largest negative number** is "−1", and the **smallest negative number** cannot be specified.
- Zero is the **smallest** non-negative number and the **largest** non-positive number.

Opposite Numbers (Additive Inverse)

- On the number line, any two numbers at the same distance from "0" and at two opposite locations from it are called **opposite numbers** (additive inverse).



The opposite of 4 is −4, **and** the opposite of −4 is 4.

So, 4 and −4 are **opposite numbers**.

4 and −4 are the additive inverse of each other.

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Exercises on lessons 1 and 2

1. Which of the following is an integer ?

a. -31	b. 7.3	c. $-\frac{3}{7}$	d. 0
e. $-\frac{9}{9}$	f. $14\frac{2}{5}$	g. 2.71	h. $\frac{15}{5}$

2. Complete.

a. The smallest natural number is ______ and the smallest counting number is ______

b. The smallest positive integer number is ______ and the greatest negative integer number is ______

c. The smallest non-negative integer is ______ and the greatest non-positive integer is ______

d. The number ______ is neither positive nor negative.

e. The integers between -3 and 2 are ______

f. The integer which just next -4 is ______

g. The integer which just before -10 is ______

h. The number of integers between -4 and 3 is ______

3. Write an integer to represent each situation :

a. A temperature is 12°C below zero. (______)

b. She's diving 10 m below sea level. (______)

c. Ahmed withdraws 6,000 pounds from his bank account. (______)

d. The tree is 4 m high. (______)

e. 3 steps forward. (______)

f. A bank deposit of 750 L.E. (______)

g. A loss of 20 L.E. (______)

h. A gain of 7 kilograms. (______)

i. A profit of 100 L.E. (______)

j. A decrease of 200 L.E. (______)

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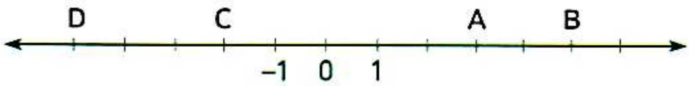
4. Write the opposite of each integer.

a. −5 ________ | b. 6 ________ | c. 0 ________
d. −16 ________ | e. 1,000 ________ | f. −(−4) ________

5. Use the number line. Write the integer for each point, then give its opposite.



a. A ________ , ________ | b. B ________ , ________
c. C ________ , ________ | d. D ________ , ________

6. Represent each of the following on the number line.

a. 3 , −4 , 1 and −2 | b. 6 , −3 , 0 , −1 , 3 and 5

7. Represent each number and its additive inverse on the number line.

a. 3 | b. −4 | c. 0

8. Write each statement, filling in each blank with the inequality symbol, < or > , that correctly completes the statement.

a. −7 ________ −3 | b. 8 ________ 0
c. 3 ________ 4 | d. 2 ________ −9
e. −6 ________ 0 | f. 2 ________ −2

9. Arrange in an ascending order.

a. 1 , −4 , −1 and 3
____

b. −7 , −9 , −4 and −1
____

c. 6 , −60 , 2 , −17 , −22 and 0
____

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10. Arrange in a descending order.

a. $-9, 0, 7$ and -15

____

b. $8, -13, -19, 0$ and -15

____

c. $1, -11, 3, -1, -8$ and 5

____

11. Write the integers between each two integers of the following.

a. -4 and 2

____

b. -1 and 5

____

12. Which are True ? Select all the true statements.

a. A number and its additive inverse are the same distance away from zero on a number line but on opposite sides.

b. All opposites are negative numbers.

c. Zero is its own additive inverse.

d. To show 5 and its additive inverse on a number line, count 5 units and plot the point 5 units to the right of 0. Then, plot the point 5 units to the left of 0.

e. The additive inverse of any number is zero.

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Quiz

$\frac{\quad}{10}$

1 Complete the following:

a) The greatest non-positive integer is ....

b) A temperature that is 4 °C below zero is written as "...............".

c) The opposite of –3 is ....

2 Choose the correct answer:

a) –4 > .... (2 or 0 or –3 or –7)

b) The integer that comes just before –3 is ....

(–4 or 4 or –2 or 2)

c) –25 ...... 12 (> or = or <)

3 Arrange the following numbers in an ascending order:

3 , –30 , –18 , 0 , 11

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Unit 2

Lessons 3 and 4

Analyzing Rational Numbers by Using Models
Comparing and Ordering Rational Numbers

Explaining

The set of Rational Numbers:

- Rational Numbers are all numbers that can be put in the form $\frac{a}{b}$.
- Where "a" is an integer, and "b" is an integer that is not equal to zero.

All fractions and mixed numbers are rational numbers.

For example: $\frac{3}{4}$, $\frac{5}{8}$, $3\frac{2}{5} = \frac{17}{5}$, $3\frac{1}{4} = \frac{13}{4}$

All decimals are rational numbers.

- Where they can be put in the form of a normal fraction $\frac{a}{b}$.

For example: $0.8 = \frac{8}{10}$, $0.23 = \frac{23}{100}$, $2.5 = \frac{25}{10}$, $24.08 = \frac{2,408}{100}$

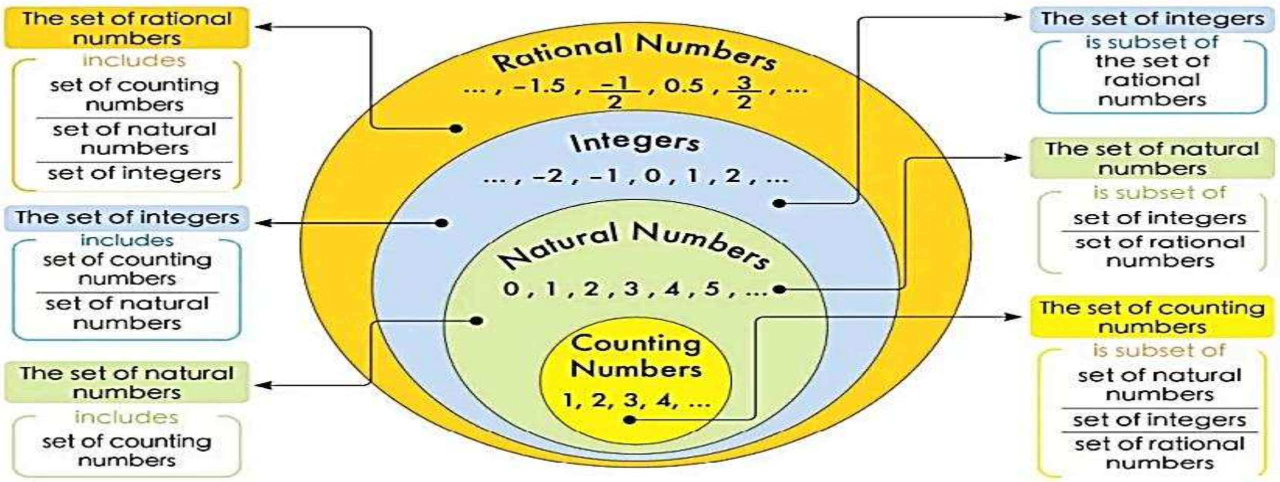
All integers are rational numbers.

- Where they can be put in the form of a normal fraction $\frac{a}{b}$.

For example: $3 = \frac{3}{1}$, $-5 = -\frac{15}{3}$, $-12 = -\frac{12}{1}$, $8 = \frac{32}{4}$, $0 = \frac{0}{1}$

Inclusion and Subsets

- We can represent the previous sets of numbers in the following Venn form, and we can say that:



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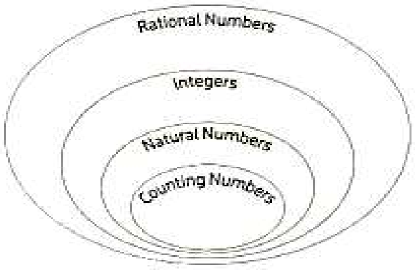
Note

- Any collection of numbers is called a set as "set of rational numbers".
- Each rational number is called an element of the set of rational numbers.

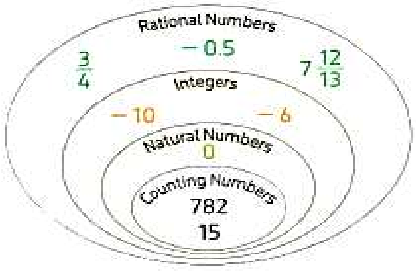
Example 1

Write the following numbers in the opposite Venn diagram

$\frac{3}{4}$, 782 , 0 , – 10 , – 0.5 , 15 , – 6 , $7\frac{12}{13}$



Solution



Example 2

Write the given rational numbers in fraction form $\frac{a}{b}$

a. – 3 | b. – 0.31 | c. $3\frac{2}{5}$ | d. 2.5

Solution

a. $-3 = \frac{-3}{1}$

b. $-0.31 = -\frac{31}{100}$

c. $3\frac{2}{5} = \frac{(3 \times 5) + 2}{5} = \frac{17}{5}$

d. $-2.5 = -\frac{25}{10}$

Note that

$-\frac{25}{10} = \frac{-25}{10} = \frac{25}{-10}$

Example 3

Match the numbers to the best subset.

rational number   integer   counting number   natural number

a. 0.785 .... b. $\frac{3}{7}$ .... c. – 428 ....

d. – 3 .... e. 0 .... f. – 13,274 ....

g. 4 .... h. 17,273 .... i. 4.8 ....

Solution

a. rational number | b. rational number | c. integer

d. integer | e. natural number | f. integer

g. counting number | h. counting number | i. rational number

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Belonging of an element to a set

We can say that – 3 belongs to set of intergers but – 3 does not belong to set of natural number.

For example :

$\frac{1}{2}$ belongs to set of rational numbers

0 does not belong to set of counting numbers.

Example 4

Write "belongs" or "does not belong".

a. $-\frac{3}{7}$ .... to set of integers.

b. 0 .... to set of natural numbers.

c. -4 .... to set of counting numbers.

d. 0 .... to set of rational number.

Solution

a. does not belong.

b. belongs.

c. does not belong.

d. belongs.

> *Math tip*
> *belong and does not belong is a relation between element and set.*

Example 5

Write "a subset" or "not a subset"

a. Set of integers is .... of set of counting numbers.

b. Set of natural numbers is .... of set of integers.

c. Set of counting numbers is .... of set of rational numbers.

d. Set of rational numbers is .... of set of natural numbers.

> *Math tip*
> *Subset and not subset is a relation between two sets.*

Solution

a. not a subset.

b. a subset.

c. a subset.

d. not a subset.

Note:

- The best subset is the smallest set that the number belongs.

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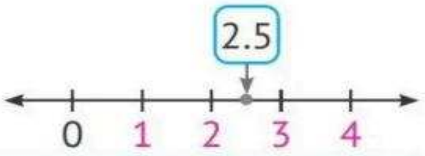
Representing Rational Numbers on a Number Line

- To determine the position of a rational number on a number line, find the two integers between which the fractions or decimals lie.

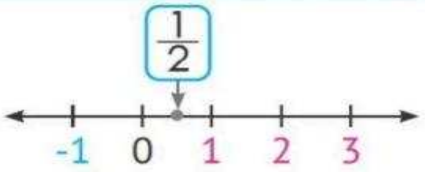
Ex. Identify the following numbers on the number line:

$$(2.5, \frac{1}{2}, -5.5, 6\frac{3}{4})$$

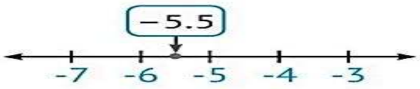
- 2.5 lies between the two integers 2 and 3.



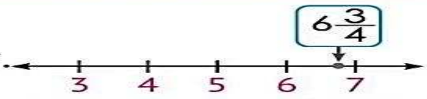
- $\frac{1}{2}$ lies between the two integers 0 and 1.



- −5.5 lies between the two integers −5 and −6.



- $6\frac{3}{4}$ lies between the two integers 6 and 7.



Note: We can determine, the additive inverse of a rational number, as:

- The additive inverse of 6.3 is −6.3 ($-\frac{63}{10}$).
- The additive inverse of $-\frac{5}{8}$ is $\frac{5}{8}$.

Comparing Two Rational Numbers

1. If the two numbers are different in sign, then the positive number is greater than the negative number.

$$0.5 > -\frac{15}{8} \quad , \quad -1.5 < \frac{1}{8}$$

2. If one of the two numbers is greater than a certain number, and the other number is less than the same number, then the first number is greater than the second number.

$$-\frac{3}{5} < -\frac{2}{5} \qquad -\frac{1}{7} > -\frac{2}{7}$$

Common Denominator   Common Denominator

$$\frac{3}{5} \;\square\; \frac{3}{7} \qquad -\frac{5}{6} \;\square\; -\frac{3}{4}$$

$$\frac{21}{35} > \frac{15}{35} \qquad -\frac{10}{12} < -\frac{9}{12}$$

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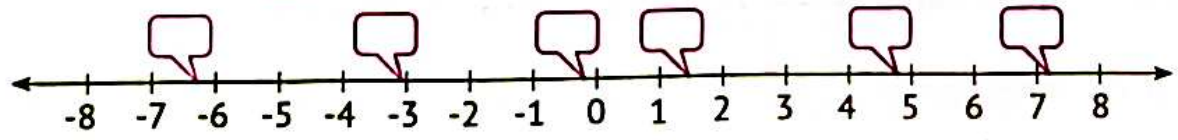
Exercises on lessons 3 and 4

1 Classify all the following numbers according to the number groups shown (put a tick ✓):

	Number	Counting Numbers	Natural Numbers	Integers	Rational Numbers
a	3				
b	–7				
c	0				
d	–7.9				
e	$\frac{3}{5}$				
f	$-\frac{4}{8}$				
g	5				
h	–0.9				
i	$3\frac{2}{5}$				
j	–4				

2 Put the following numbers in the appropriate places on the number line:

-3 , 1.5 , $-\frac{3}{8}$, $-6\frac{1}{4}$, $4\frac{2}{3}$, 7.2



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3 Write each of the following numbers in fraction form $\frac{a}{b}$, then write its additive inverse:

Number	2.5	−0.8	5	$-3\frac{1}{2}$	$2\frac{3}{4}$
Fraction Form $\frac{a}{b}$	....	....	....	....	....
Additive Inverse	....	....	....	....	....

4 Complete using (< , = or >):

a) $\frac{2}{5}$ ☐ $\frac{3}{5}$ b) $-\frac{6}{7}$ ☐ $\frac{7}{7}$ c) $-\frac{5}{9}$ ☐ $\frac{8}{9}$

d) $\frac{3}{8}$ ☐ $\frac{3}{5}$ e) $-\frac{2}{5}$ ☐ $\frac{2}{3}$ f) $-\frac{4}{5}$ ☐ $\frac{4}{7}$

g) $\frac{2}{7}$ ☐ $\frac{1}{3}$ h) $\frac{3}{4}$ ☐ $-\frac{4}{5}$ i) $-\frac{2}{7}$ ☐ $-\frac{3}{4}$

j) 0.5 ☐ $\frac{1}{2}$ k) 2.4 ☐ $\frac{24}{100}$ l) $-2\frac{1}{3}$ ☐ 0

5 Arrange each of the following groups of numbers in ascending and descending order:

a) $2\frac{2}{3}$, −5.5 , $7\frac{1}{4}$, 3.7 , $-1\frac{3}{5}$

Ascending order: .... , ... , ... , ... , ...

Descending order: .... , ... , ... , ... , ...

b) $\frac{1}{2}$, $\frac{2}{3}$, −0.82 , 0.25 , $-\frac{1}{2}$

Ascending order: .... , ... , ... , ... , ...

Descending order: .... , ... , ... , ... , ...

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c $-5\frac{1}{5}$, 2.2 , $-5\frac{1}{4}$, −5.5 , $2\frac{3}{4}$

Ascending order: .... , ... , ... , ... , ...

Descending order: .... , ... , ... , ... , ...

6 Choose the correct answer from the brackets:

a The number (−2.5) is a/an ....

(counting number or natural number or integer or rational number)

b The number (5) is not a/an ....

(counting number or natural number or integer or even number)

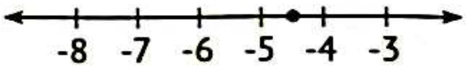
c The number (0) is a/an ....

(counting number or natural number or negative integer or odd number)

d The opposite of $-\frac{3}{4}$ is .... ($1\frac{1}{3}$ or $\frac{4}{3}$ or $-\frac{4}{3}$ or $\frac{3}{4}$)

e −6 in $\frac{a}{b}$ form is .... ($\frac{6}{1}$ or $\frac{1}{6}$ or $-\frac{6}{1}$ or $-\frac{1}{6}$)

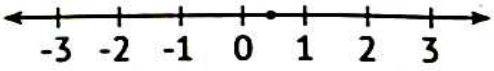
f The rational number represented on



the corresponding number line is ....

($4\frac{2}{3}$ or $5\frac{2}{3}$ or $-4\frac{2}{3}$ or $-5\frac{2}{3}$)

g The rational number represented on



the corresponding number line is .... (− 1.5 or −0.5 or 1.5 or 0.5)

h The additive inverse of $\frac{3}{5}$ .... $-\frac{5}{3}$ (> or = or <)

i $-\frac{7}{4}$ > .... ($-\frac{8}{4}$ or $\frac{8}{4}$ or $-1\frac{3}{4}$ or $\frac{7}{4}$)

j $\frac{2}{3}$ < .... ($\frac{2}{3}$ or $-1\frac{2}{3}$ or $-\frac{3}{2}$ or $\frac{3}{2}$)

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Quiz 1

$\frac{\quad}{10}$

Choose the correct answer.

1. All the following numbers are rational except ....
   A. 0 B. $\frac{2}{5}$ C. $\frac{3-3}{7}$ D. $\frac{4}{5-5}$

2. Which of the following numbers is an integer? ....
   A. $-\frac{24}{5}$ B. $\frac{4}{8}$ C. $\frac{15}{5}$ D. 3.2

3. -17.3 in the form $\frac{a}{b}$ is ....
   A. $\frac{173}{1,000}$ B. $-\frac{173}{100}$ C. $\frac{173}{10}$ D. $-\frac{173}{10}$

4. The smallest non-negative rational number is ....
   A. 0.1 B. $\frac{1}{2}$ C. 1 D. 0

5. -4 .... set of counting numbers.
   A. belongs to B. does not belong to
   C. is a subset of D. is not a subset of

6. Set of integers .... set of rational numbers.
   A. belongs to B. does not belong to
   C. is a subset of D. is not a subset of

7. The best subset of the number 1 is ....
   A. rational number B. integer
   C. natural number D. counting number

8. The best subset of the number -10 is ....
   A. rational number B. integer
   C. natural number D. counting number

9. The best subset of the number 0 is ....
   A. rational number B. integer
   C. natural number D. counting number

10. Each number in the set of integers is called ....
   A. element B. set
   C. subset D. not subset

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Quiz 2

$\frac{\quad}{10}$

Choose the correct answer.

1. $\frac{3}{5}$ ◯ $\frac{2}{7}$
   A. >　　B. <
   C. =

2. 0.7 ◯ 0.65
   A. >　　B. <
   C. =

3. $-\frac{1}{4}$ ◯ $-\frac{2}{9}$
   A. >　　B. <
   C. =

4. $\frac{2}{8}$ ◯ 0.5
   A. >　　B. <
   C. =

5. ______ is lying between 3.14 and 3.2
   A. 3.15　　B. 3.21
   C. 3.20　　D. 3.22

6. The number of rational numbers lying between $\frac{2}{5}$ and $-\frac{2}{5}$ is ______
   A. 0　　B. 1
   C. 2　　D. an infinite number

7. 2.8 > ______
   A. 3.1　　B. 4
   C. – 5.8　　D. 7.9

8. – 3.25 < ______
   A. – 6.3　　B. 0
   C. $-7\frac{1}{2}$　　D. $-3\frac{1}{2}$

9. The smallest number from the following is ______
   A. 0.11　　B. 0.3
   C. $\frac{1}{2}$　　D. 0.101

10. The greatest number from the following is ______
   A. $\frac{1}{2}$　　B. $\frac{1}{3}$
   C. $\frac{1}{4}$　　D. $\frac{1}{12}$

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Unit 2

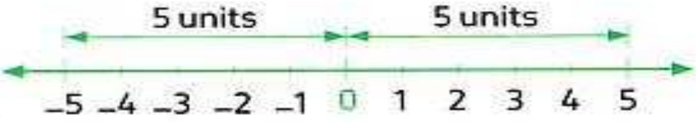
Lessons 5 and 6

Exploring Absolute Value
Comparing Absolute Values

Explaining

Learn 1 What is the absolute value ?

The absolute value of a rational number is its distance from zero. Since distance is positive, or zero. then the absolute value of either a positive or a negative rational number is positive. The absolute value of 5 is written $|5|$. On the number line above, both 5 and -5 are 5 units from 0.



So, $|5| = 5$ and $|-5| = 5$.

Note

$|-11| = |11|$ because both are 11 units from 0

Example 1

Find the value of each of the following.

a. $|-4|$
b. $-|4|$
c. $|0|$
d. $-|-\frac{3}{7}|$
e. $|-3| + |5|$
f. $|-2| + |-7|$
g. $|-6| - |6|$
h. $|-3| \times |-2|$
i. $|-10| \div |2|$

Solution

a. $|-4| = 4$
b. $-|4| = -4$
c. $|0| = 0$
d. $-|-\frac{3}{7}| = -\frac{3}{7}$
e. $|-3| + |5| = 3 + 5 = 8$
f. $|-2| + |-7| = 2 + 7 = 9$
g. $|-6| - |6| = 6 - 6 = 0$
h. $|-3| \times |-2| = 3 \times 2 = 6$
i. $|-10| \div |2| = 10 \div 2 = 5$

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Example 2

Find the value of x :

a. $|x| = 5$ | b. $|x| = 10$ | c. $|x| = 0$ | d. $|-7| = x$

Solution

a. Since $|x| = 5$, then $x = 5$ or $x = -5$

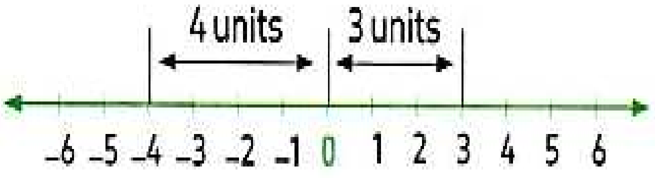
b. Since $|x| = 10$, then $x = 10$ or $x = -10$

c. Since $|x| = 0$, then $x = 0$

d. Since $|-7| = x$, then $x = 7$

Learn 2 Comparing Absolute Values.

From the opposite number line the distance from -4 and 0 greater than the distance from 3 and 0 then $|-4| > |3|$



We can deduce that : $|-4| < |-5|$

Example 3

Compare using (>, < or =).

a. $|-2|$ ○ $|-7|$

b. $|-2.8|$ ○ -2.8

c. $3\frac{1}{4}$ ○ $|-3\frac{2}{3}|$

d. $|-4.25|$ ○ 4.3

Solution

a. $<$ | b. $>$ | c. $<$ | d. $<$

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Exercises on lessons 5 and 6

1 Find the value of each of the following:

a) $|-5| =$ ....
b) $|-15| =$ ....
c) $|6| =$ ....
d) $|45| =$ ....
e) $|\frac{7}{9}| =$ ....
f) $|7\frac{3}{5}| =$ ....
g) $|-\frac{3}{4}| =$ ....
h) $|-7\frac{2}{3}| =$ ....
i) $|0.03| =$ ....
j) $|-0.7| =$ ....
k) $|7.04| =$ ....
l) $|-6.5| =$ ....

2 Complete using (< , = or >):

a) -0.7 ☐ $|-0.7|$
b) $|-9|$ ☐ $|-8|$
c) 5.07 ☐ $|-5.07|$
d) $|3.4|$ ☐ $|-3.4|$
e) $|1.8|$ ☐ 1.8
f) $|-8.2|$ ☐ -7.9
g) $|-2.71|$ ☐ 2.7
h) $|-75|$ ☐ 64
i) $|\frac{2}{3}|$ ☐ $|-\frac{1}{3}|$
j) $-\frac{7}{8}$ ☐ $|-\frac{7}{9}|$
k) $|3\frac{1}{4}|$ ☐ $|-7\frac{2}{5}|$
l) $4\frac{3}{4}$ ☐ $|2\frac{2}{3}|$
l) $|-\frac{8}{3}|$ ☐ $|2\frac{2}{3}|$
m) $-3\frac{4}{5}$ ☐ $|-\frac{3}{2}|$
n) $|-3|$ ☐ -3
o) $-|\frac{3}{4}|$ ☐ $|-\frac{3}{4}|$

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3 Arrange each group of the following numbers in ascending and then descending order:

a $8 , -17 , |-3| , -9 , |12|$

Ascending order: .... , ... , ... , ... , ...

Descending order: .... , ... , ... , ... , ...

b $7.3 , -2.7 , |6.7| , -4.8 , |-1.5|$

Ascending order: .... , ... , ... , ... , ...

Descending order: .... , ... , ... , ... , ...

c $\frac{3}{4} , -\frac{5}{8} , |-\frac{1}{2}| , -\frac{3}{4} , |\frac{1}{4}|$

Ascending order: .... , ... , ... , ... , ...

Descending order: .... , ... , ... , ... , ...

4 Complete the following:

a If $5 = |a|$, then a = ... or ....

b If $b = |-7|$, then b = ...

c If $n = |9|$, then n = ...

d $-|5|$ = ...

e $-|-4|$ = ...

f $|9| + |-9|$ = ...

g If the temperature recorded in Moscow is – 6 and the temperature recorded in Cairo is 4, then the temperature of .... is lower because –6 .... 4.

h If the height of mountain (A) above sea level is 1,200 m, and the height of mountain (B) above sea level is 1,400 m, then the mountain .... lies at a distance closer to sea level.

i Which is bigger –7.22 or –7.2? ....

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Quiz

$\frac{\quad}{10}$

Choose the correct answer.

1. $|-7| >$ ______
   A. $|-6|$ B. $|-7|$
   C. $|-8|$ D. $|-9|$

2. $|-1.34| <$ ______
   A. 1.4 B. −1.29
   C. −1.4 D. 1.19

3. $|-3\frac{1}{4}|$ ◯ 3.12
   A. > B. <
   C. =

4. The absolute values of opposites are ______
   A. equal B. different
   C. negative

5. A negative number with an absolute value greater than 10 is ______
   A. 10 B. 11
   C. −9 D. −12

6. $|-10| + |-2|$ ◯ $|20| - |-10|$
   A. > B. <
   C. =

7. $|-2\frac{1}{4}| \div |\frac{1}{2}| =$ ______
   A. $4\frac{1}{4}$ B. $4\frac{1}{2}$
   C. $\frac{9}{8}$ D. 4

8. $|-4| + |2\frac{1}{3}| =$ ______
   A. 6 B. $6\frac{1}{3}$
   C. $7\frac{1}{3}$ D. 8

9. $|x|$ ◯ −1
   A. > B. <
   C. =

10. $|2| \times |-2| =$ ______
    A. 0 B. 4
    C. −4 D. −1

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Unit 3

Lessons 1 and 2

Creating Mathematical Expressions
Analyzing Mathematical Expressions

Explaining

Ex. • If the price of one pen is 3 pounds, then the price of:

2 pens:	3	X	2
3 pens:	3	X	3
4 pens:	3	X	4
5 pens:	3	X	5

Values don't change → **Constant**

Values change → **Variable**

- The price of the pen is constant.
- The number of purchased pens is variable.

Constant

- It is a number or a letter that represents a single number.

Ex. 5 , − 1.2 , 127 , $\frac{5}{9}$

Variable

- It's a symbol, usually a letter, representing an unknown quantity that may vary or change.

Ex. x , y , z , ...

Algebraic Term

- The product of multiplying numbers and variables.

Constant → $4n$ ← Variable

Constant → $-\frac{5}{6}xy$ ← Variable

Algebraic term may be:

A variable only, → such as: x , y , z , ... its coefficient is "1".

A constant only, → such as: 5 , − 1.2 , 127 , $\frac{5}{9}$

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Mathematical Expressions

- Numerical Expression
- Algebraic Expression

Numerical Expression

- It is a mathematical statement that contains a group of numbers and at least one operation.

Ex. 15 + 23 – 0.36

Algebraic Expression

- It is a mathematical statement that may contain a group of numbers, variables, operation symbols ("+" , "–"), or any of them.
- Or, it consists of one or more algebraic terms separated by a "+" or "–" sign.

Ex. $2x - 3$

Coefficient: 2 — Variable: x — Constant: 3

Algebraic Term: $2x$, 3

$x + 2$, $5x + 3y$

$xy - 3y + 4$

Like and Unlike Terms

- Algebraic terms are like if they have the same variable exactly.
- Examples of like algebraic terms: ($2a$, $-5a$, a) , ($5xy$, $-7xy$, xy)
- Examples of unlike algebraic terms: ($6y$, $-8ab$, $9x$)

Note: • All numerical terms (constants) are like terms.

Ex. Complete the following table:

	Expression	Number of Terms	Like Terms
ⓐ	5	1	None
ⓑ	8 + 2	2	2, 8
ⓒ	$5b + 6 + 2b$	3	$5b$, $2b$
ⓓ	$3x + 7$	2	None

Writing a mathematical expression:

Ex. If an astronaut is approximately 0.05 meters taller while traveling in space than he is on Earth, write a mathematical expression that represents the astronaut's height on Earth if his height in space is h meters.

Answer: Mathematical expression: $h - 0.05$

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Exercises on lessons 1 and 2

1 Complete the following table:

	Algebraic Term	Number of Factors	Coefficient	Algebraic Factors
Ex.	$9xy$	3	9	x, y
a	$3m$	....	....	....
b	$-5y$	....	....	....
c	$\frac{1}{3}ab$	....	....	....
d	$-\frac{3}{7}n$	....	....	....
e	$6xyz$	....	....	....

2 Classify the following mathematical expressions into numerical expressions or algebraic expressions: Put a tick (✓):

	Mathematical Expression	Numerical Expression	Algebraic Expression
a	$3 + 0.2 - 1.25$	....	....
b	$5x - 3$	....	....
c	9×2.7	....	....
d	$2a + 3c - 5$	....	....
e	$9x$	....	....

3 Complete the following table:

	Mathematical Expression	Variables	Absolute Term (Constant)	Coefficients
Ex.	$3a + 6b + 7$	a, b	7	3, 6
a	$-8xy + \frac{1}{3} + 20$	x, y	$\frac{1}{3}$, 20	-8
b	$2a + 7 + 4a$	....	....	....
c	$17 + 5 + x$	....	....	....
d	$22 + \frac{1}{5} + 2y$	....	....	....
e	$0.2q + 0.6r + 0.8s$	....	....	....
f	8	....	....	....

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4 Complete the following table:

	Expression	Number of Terms	Like Terms
a	$x + \frac{3}{8}x + 3$		
b	$m + 3 + 2m + 2$		
c	$16x + 2x$		
d	$7x + 7x + 1 + 2x$		

5 Write a mathematical expression for each of the following situations:

a. Two numbers whose sum is 12, one of them is "d" so the other number is (________)

b. Ahmed's age exceeds his brother Essam's by three years, so if Essam's age is "x" years then Ahmed's age is (________)

c. If Ramez has $\frac{1}{5}$ of Emad has and if Emad has "w" pounds, then what Ramez has is (________)

d. If Hani has "x" pounds and he takes 10 pounds from his father, then Hani now has ________ pounds.

6 Choose the correct answer:

a. The algebraic term "$\frac{1}{5}x$" consists of ______ a factor. (1 or 2 or 3 or 4)

b. In the algebraic term "$-3 \times y$", the coefficient is ______.

(y or x or 3 or -3)

c. In the algebraic term "$\frac{3}{8}$ a", the algebraic factor is ______.

(a or 8 or 3 or $\frac{3}{8}$)

d. The number of terms that make up the algebraic expression "$5x + 3y + 2$" is ______. (2 or 3 or 5 or 6)

e. The number of terms that make up the algebraic expression "$8 + 3 \times y$" is ______. (2 or 3 or 4 or 5)

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(f) Like terms for the algebraic expression "5 + 5y + 2y" are ....

(5 , 5 y or 5 y , 2 y or 5 , 2 y or 5 , 5y , 2y)

(g) Like terms for the algebraic expression "2 + 3 b + 2 a" are ....

(2 , 3 b or 2 , 2 a or 3 b + 2 a or none)

(h) In the algebraic expression "3 y + 9", the constant is ....

(9 or 3 or y or 3 y)

(i) In the algebraic expression "5 a + 3 b + 2 + 4", the coefficients are ....

(2 , 4 or 5 , 3 or a , b or 5 , 3 , 2 , 4)

(j) If the height of the school building is "m" meters and the height of the tree adjacent to this building 10 meters less than it, then height of the tree is .... meters.

(m + 10 or m – 10 or 10 m or $\frac{m}{10}$)

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Quiz

10

Choose the correct answer.

1. Which of the following is an algebraic expression ? ______
   A. $44 - 3 \times 4$ B. $3 + 7 - 0$
   C. $15a - 32$ D. $2(3 + 14)$

2. The number of like terms in the expression $3 + 2x + 5$ is ______
   A. 1 B. 2
   C. 3 D. 4

3. The constant in the expression $2x + 5$ is ______
   A. 2 B. $2x$
   C. $2x + 5$ D. 5

4. Which of the following are like terms ?
   A. 25 , 52 B. ab , bc
   C. ab , aq D. ℓ , m

5. The coefficients in the algebraic expression $5 + 3y + 2x + 1$ are ______
   A. 5 , 3 , 2 , 1 B. 3 , 2
   C. 3 , 2 , 1 D. 5 , 1

6. A teacher decided to give each pupils 5 marks more, which expression does represent that ?
   A. 5 B. $5x$
   C. $5 - x$ D. $5 + x$

7. If the pre-fare of taxicab is 10 L.E. and 5 L.E. per covered 1 km, which of the following does represent the total fare ?
   A. $5 + 10$
   B. $10 - 5n$
   C. $5 + 10n$
   D. $10 + 5n$

8. If you know that the temperature decreases 1 degree for each 150 meter above sea, level if temperature at sea level is 37 degree, which of the following represents the temperature at a hight h meter above sea level.
   A. $150h$ B. $37 + 150h$
   C. $37 - \frac{h}{150}$ D. $37 - h$

9. $2 + 3[$ ______ $] + 5$, complete to get a numeric expression.
   A. a
   B. k
   C. $30 \div 5$
   D. $b + c$

10. In the expression $2a + 3 + a + 2$, which of the following isn't true ?
    A. 3 , 2 are the constants
    B. 2 a and 2 are like terms
    C. The coefficients are 2 , 1
    D. Number of terms are 4

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Unit 3 Lessons 3

Writing Algebraic Expressions

Explaining

Converting Algebraic Expressions into Verbal Expressions

- The algebraic expression can be written in words. This is called a verbal expression.

- There are words or phrases that can be used to suggest the operation in a mathematical problem, such as:

Addition

- Added to
- More
- And
- Sum
- Plus
- Together
- The total
- Exceeded
- Increase

For example:

- x plus 8 is $x + 8$.
- The sum of x and 2 is $x + 2$.

Subtraction

- Subtracted
- Less
- Minus
- How much is
- The increase
- The decrease
- The difference
- Take away

For example:

- x minus 3 is $x - 3$.
- 7 minus x is $7 - x$.

Multiplication

- Times
- Times of
- Multiplied by
- Each
- Double
- Twice
- Product
- Multiplication
- Triple
- Thrice

For example:

- Twice x is $2x$.
- 5 multiplied by x is $5x$.
- 3 times x is $3x$.
- 4 times x is $4x$.

Division

- Divided by
- Ratio
- For each
- Half/quarter...
- Quotient
- Division
- Distribution

For example:

- Half of x is $\frac{1}{2}x = \frac{x}{2}$.
- Third of x is $\frac{1}{3}x = \frac{x}{3}$.

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Ex.

The following algebraic expression can be expressed using the verbal form in more than one way:

$x + 2$

- The sum/ total of x and 2
- x plus 2
- x increased by 2
- 2 more than x
- 2 greater than x
- 2 added to x

Important Notes:

- An algebraic expression can have **more than one** operation.
- Parentheses are used to express the **result** of addition or subtraction.

Ex. The following algebraic expressions have two operations:

$2x + 5$ Sum of the double of x and 5	$2(x + 5)$ Double of the sum of x and 5
$7x - 3$ The difference between 7 times x and 3	$7(x - 3)$ 7 times the difference between x and 3

Notice the change in the verbal expression when using parentheses.

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Exercises on lesson 3

1 Express each of the following verbal forms using algebraic expressions:

a) Adding "z" to 36 (..................)

b) 5 less than "x" (..................)

c) 9 more than "a" (..................)

d) Three times of "b" (..................)

e) Product of "p" and 7.5 (..................)

f) Subtract 14 from "y" (..................)

g) Divide "h" by 6 (..................)

h) 9 divided by "r" (..................)

i) "a" increased by 3.5 (..................)

j) The sum of half "q" and 4 (..................)

k) 7 subtracted from twice "w" (..................)

l) Double of "v" minus 3 (..................)

m) Twice the sum of "g" and 6 (..................)

n) Three times the difference between "s" and 2 (..................)

o) The sum of three times "a" and 5 (..................)

p) Ammar has "x" coins, Tamer has 7 more than Ammar. (..................)

q) Baher has "m" stickers in the sticker book and then puts up 12 more stickers. (..................)

r) A student shared an orange equally with 2 of his friends.

(..................)

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2 Write each of these algebraic expressions using the verbal form:

a) $a + 9$: ....

b) $b - 6$: ....

c) $7.5 - f$: ....

d) $12y$: ....

e) $8 \div s$: ....

f) $K \div r$: ....

g) $3x + 6$: ....

h) $7 - 2x$: ....

i) $\frac{1}{2}(m + 3)$: ....

j) $5(c - 3)$: ....

3 Choose the correct answer:

a) If we subtract 5 from the number "x", the result is ....

($x + 5$ or $x - 5$ or $5 - x$ or $5x$)

b) Ziyad saved "x" pounds and his father gave him 10 pounds, so that he would have ....

($x - 10$ or $x + 10$ or $10x$ or $10 - x$)

c) The algebraic expression representing (subtract 3 from twice the number "x") is ....

($x - 3$ or $2x - 3$ or $3x + 2$ or $5x$)

d) The algebraic expression representing (the difference between three times the number "y") and 2 = ... ($3y - 2$ or $2y - 3$ or $3 \times 2x$ or $\frac{3x}{2}$)

e) The algebraic expression that represents (three times the sum of the number "m") and 12 is ....

($3m + 12$ or $3(m + 12)$ or $12m + 3$ or $12(m + 3)$)

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ⓕ The algebraic expression representing (half the difference between the number "a" and 7) is ....

$(\frac{1}{2}a - 7$ or $\frac{1}{2}a - 7$ or $\frac{1}{2}(a - 7)$ or $\frac{1}{2}(a + 7))$

ⓖ If Basim is "x" years old now, how old will he be after 5 years? ....

$(x - 5$ or $x + 5$ or $5 \div x$, or $5x)$

ⓗ Which of the following operations expresses the mathematical expression (double the number plus 4) ....

$(+, -$ or $\times, -$ or $\times, +$ or $\times, \div)$

4 Match each verbal expression with the appropriate algebraic expression:

ⓐ Twice the sum of "a" and 4 •	• $2a + 4$ 1
ⓑ The sum of twice of "a" and 4 •	• $4a$ 2
ⓒ The sum of "a" and 4 •	• $2(a + 4)$ 3
ⓓ Product of "a" by 4 •	• $a + 4$ 4

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Quiz

$\frac{\quad}{10}$

Choose the correct answer.

1. If we subtract 5 from the number x, we get ______
   A. 5x B. 5 – x
   C. x – 5 D. x + 5

2. Suzan saved L.E. x and her father gave her L.E. 10 she will have ______
   A. x – 10 B. x + 10
   C. 10 x D. 10 – x

3. Subtracting 3 from double a number = ______
   A. n – 3 B. 2n – 3
   C. 3n + 2 D. 5n

4. Three times a number less two is ______
   A. 3x + 2 B. 3x – 2
   C. 2 × 3x D. $\frac{3x}{2}$

5. If three times a number is added to 12, then the algebraic expression that expresses this is ______
   A. q + 12 B. q – 12
   C. 3q + 12 D. 3q – 12

6. Twice the sum of a number and five is ______
   A. 2y + 5 B. 2y – 5
   C. 2 (y + 5) D. 2 (y – 5)

7. Bassem is k years old now, how old will he be after 5 years?
   A. 5k B. 5 ÷ k
   C. k – 5 D. k + 5

8. What operations are in the algebraic expression for "twice a number increased by three"?
   A. + and – B. × and –
   C. × and + D. + and –

9. The verbal expression for 5x – 7 is ______
   A. 5 multipled by x increased by 7
   B. 5 times a number x, less than 7
   C. 5 times a number x, less 7
   D. 7 decreased by 5x

10. The verbal expression for 3 (y + 4) is ______
    A. Three times y is increased by 4
    B. The sum of y and three times 4
    C. y less 4 multiplied by 3
    D. The product of 3 and the sum of y and 4

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Unit 3 Lessons 4

Ordering of Operations and Exponents

Explaining

Remember

Steps of the Order of Operations

1. Perform operations within parentheses ( ).
   1. Multiply or divide from left to right.
   2. Add or subtract from left to right.
2. Perform operations within brackets [ ].
   1. Multiply or divide from left to right.
   2. Add or subtract from left to right.
3. Perform operations outside of parentheses or brackets.
   1. Multiply or divide from left to right.
   2. Add or subtract from left to right.

Ex. Use the order of operations to evaluate the expression:

8 X [24 ÷ (4 + 2) - 1] + 5

Operations within parentheses — Adding → = 8 X [24 ÷ 6 - 1] + 5

Operations within brackets — 1 Dividing → = 8 X [4 - 1] + 5

2 Subtracting → = 8 X 3 + 5

Operations outside brackets — 1 Multiplication → = 24 + 5

2 Adding → = 29

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Repeated Multiplication

- Repeated multiplication is the repeated multiplication of a number by itself a number of times.

Ex. $2 \times 2 \times 2 \times 2$ (It is a repeated multiplication of 2 by itself 4 times.)

Repeated multiplication $2 \times 2 \times 2 \times 2$ can be written as 2^4.

And it's read as: 2 to the power of 4 **Or** The fourth power of 2

- We note that:
  - 2 is the repeated number and is called the "base".
  - 4 is the number of repetitions, and is called the "exponent, power, or index".

Exponent → 4, Base → 2: 2^4

Ex. $4 \times 4 \times 4 = 4^3$, and it's read as: **4 to the power of 3.**

Important Notes:

- Any number to the power of 1 = itself.

For example: • $3^1 = 3$ "3 to the power of 1 or the first power of 3"

The power of 1 is not written.

- $3 \times 3 = 3^2$ "3 to the power of 2, or the second power of 3 or the square of 3."

- $4 \times 4 \times 4 = 4^3$ "4 to the power of 3, or the third power of 4 or the cube of 4."

- $2^5 \neq 2 \times 5$

"Because: $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$ While $2 \times 5 = 10$"

- Any number to the zero power equals 1. (Except zero)

For example: $3^0 = 1$, $6^0 = 1$, $(-4)^0 = 1$

- 1 to the power of any number = 1.

For example: $1^9 = 1$, $1^5 = 1$, $1^7 = 1$

- 0 to the power of any number = 0. (Except zero)

For example: $0^6 = 0$, $0^2 = 0$, $0^{23} = 0$

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Order of Operations and Exponents

- When the expression contains exponents, the value of the exponents is calculated before multiplication and division.

1 Perform operations within parentheses ( ).	2 Perform operations within brackets [ ].	3 Perform operations outside of parentheses or brackets.
1 Exponents 2 Multiply or divide from left to right. 3 Add or subtract from left to right.	1 Exponents 2 Multiply or divide from left to right. 3 Add or subtract from left to right.	1 Exponents 2 Multiply or divide from left to right. 3 Add or subtract from left to right.

Ex. Use the order of operations to evaluate the expression:

ⓐ $(15 - 9) + 3 \times 4^2 \div 2$

$= 6 + 3 \times 4^2 \div 2$

$= 6 + 3 \times 16 \div 2$

$= 6 + 48 \div 2$

$= 6 + 24$

$= 30$

ⓑ $6^2 \div (17 - 8) \times (3 + 4)$

$= 6^2 \div 9 \times 7$

$= 36 \div 9 \times 7$

$= 4 \times 7$

$= 28$

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Exercises on lesson 4

1 Complete the following:

a) $5 \times 5 \times 5 \times 5 = 5^{......}$

b) $4 \times 4 \times 4 = 4^{......}$

c) $3 \times 3 \times 3 \times 3 \times 3 = ...^{5}$

d) $8 \times 8 \times 8 = ...^{3}$

e) $2 \times 2 \times 2 \times 2 = ...^{......}$

f) $6 \times 6 \times 6 = ...^{......}$

g) $7^2 = ... \times ......$

h) $6^4 = ... \times ...... \times ...... \times ......$

i) $10^2 = ... \times ......$

j) $1^5 = ... \times ...... \times ...... \times ...... \times ......$

k) $5^3 = ... \times ...... \times ......$

l) $2^2 = ... \times ......$

2 Find the value:

a) $5^2 = ...$

b) $3^3 = ...$

c) $2^5 = ...$

d) $1^4 = ...$

e) $1^3 = ...$

f) $10^3 = ...$

g) $0^2 = ...$

h) $0^3 = ...$

i) $1^8 = ...$

j) $1^{10} = ...$

k) $6^0 = ...$

l) $9^0 = ...$

3 Follow the order of performing operations, then find the value of each of the following:

a) $4 + 5 \times 6$
= ......
= ......

b) $18 - 12 \div 3$
= ......
= ......

c) $15 \div 3 + 7$
= ......
= ......

d) $7 \times 7 - 24$
= ......
= ......

e) $9 + 9 - 8$
= ......
= ......

f) $15 - 3 + 7$
= ......
= ......

f) $6 \times 6 + 4$
= ......
= ......

g) $48 \div 8 \times 2$
= ......
= ......

h) $5 \times 2 + 3 \times 4$
= ......
= ......

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4 Follow the order of performing operations, then find the value of each of the following:

(a) $(3 + 6) \times 2$
= ....
= ....

(b) $15 \div (2 + 3)$
= ....
= ....

(c) $8 \times (12 + 4)$
= ....
= ....

(d) $[3 \times (9 - 4)] - 10$
= ....
= ....

(e) $5 \times [12 + (4 + 2)]$
= ....
= ....

5 Follow the order of performing operations, then find the value of each of the following:

(a) $4^2 + 2 \times 3$
= ....
= ....

(b) $2^4 - 3^2$
= ....
= ....

(c) $10^2 \div 5$
= ....
= ....

(d) $45 - 6^2$
= ....
= ....

(e) 3×1^3
= ....
= ....

(f) $48 \div 4^2$
= ....
= ....

(g) $3 \times 2^3 \div 12$
= ....
= ....
= ....

(h) $8 + 5^2 - 30$
= ....
= ....
= ....

(i) $2 \times 10^2 + 15$
= ....
= ....
= ....

(j) $2^2 \times 3 - 10$
= ....
= ....
= ....

(k) $6^2 \div 9 + 5$
= ....
= ....
= ....

(l) $4^3 + 2 \times 5$
= ....
= ....
= ....

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6 Follow the order of performing operations, then find the value of each of the following:

a) $4^2 + (15 - 7) \times 2$

= ....

= ....

= ....

b) $(2^5 + 3) \div (2^3 - 1)$

= ....

= ....

= ....

c) $3 \times [5^2 - (4 \times 6)]$

= ....

= ....

= ....

d) $[5^2 \times (6^2 \div 9)] - 24$

= ....

= ....

= ....

7 Choose the correct answer:

a) $4^2 =$ .... (4×2 or 4×4 or $4 + 2$ or $4 + 4$)

b) $3^0 =$ .... (3 or 0 or 1 or 3×0)

c) $1^5 =$ .... (1×5 or $1 + 5$ or 1 or 0)

d) $2 \times 2 \times 2 \times 2 \times 2 =$ .... (2^5 or 5^2 or 2×5 or $2 + 5$)

e) $5 \times 5 \times 5 =$ .... (3^5 or 5^3 or $5 + 3$ or 5×3)

f) $4^{\dots} = 1$ (0 or 1 or 2 or 5)

g) $5^{\dots} = 5$ (0 or 1 or 2 or 5)

h) $3^4 =$ .... ($4 \times 4 \times 4$ or $3 \times 3 \times 3 \times 3$ or 3×4 or $3 + 4$)

i) 2^4 ...... 4^2 ($<$ or $=$ or $>$ or $\geq$)

j) 3^2 ...... 2^3 ($<$ or $=$ or $>$ or $\geq$)

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k) $5 \times 3 + 2^2 =$ .... (35 or 19 or 51 or 17)

l) $2^3 \times (5^2 + 75) =$ .... (800 or 275 or 210 or 135)

m) $3^2 + 3^2 + 3^2 =$ .... (3^6 or 9^2 or 3^3 or 9^6)

8 Complete the following:

a) In 5^7: 5 is called .... and 7 is called ....

b) In 3^8: 3 is called .... and 8 is called ....

c) In .... : 4 is called the base and 2 is called the exponent.

d) In .... : 8 is called the base and 3 is called the exponent.

e) Six cubed = ...

f) Seven squared = ...

g) Four to the power 5 = ...

h) .... to the power .... = 6^4

i) If $3^x = 81$, then the value of x is ....

j) If $y^3 = 64$, then the value of y is ....

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Quiz

$\frac{\quad}{10}$

1 Find the value of:

a) 3^3 = ...

b) $48 \div 8 \times 2$ = ...

c) $8 \times (12 \div 4)$ = ...

d) $8 + 5^2 - 30$ = ...

e) $(2^5 + 3) \div (2^3 - 1)$ = ...

2 Choose the correct answer:

a) 4^3 = ... ($4 + 3$ or 4×3 or $4 + 4 + 4$ or $4 \times 4 \times 4$)

b) $(10 \times 3 - 8) - 5 \times (6 - 2)$ (8 or 0 or 2 or 68)

c) 3^2 ☐ 2^3 ($<$ or $=$ or $>$ or $\leq$)

d) $2^3 + 2^3$ = ... (4^3 or 3^4 or 2^4 or 4^6)

e) $7^{\cdots} = 7$ (0 or 1 or 2 or 10)

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Unit 3

Lessons 5 to 7

Evaluating Algebraic Expressions
Applications on Algebraic Expressions
Determining Equivalent Algebraic Expressions

Explaining

Write an Algebraic Expression

Ex. If the price of a small bottle of water is 3 pounds. Find the price of "x" bottles.

Answer:
- The price of a bottle is constant, while the number of bottles changes.
- The price of "x" bottles is $3x$.

Ex. If the price of one shirt is 100 pounds and you have a coupon for 40 LE off your entire purchase. Find the price of "y" shirts.

Answer:
- The price of a shirt is constant, while the number of shirts changes.
- The price of "y" shirts (before using coupon) is $100y$.
- The price of "y" shirts (after using coupon) is $100y - 40$.

Evaluating the Algebraic Expression

- You can find the value of an algebraic expression by replacing the variable used with a numerical value, and then follow the order of operations to find the numerical value of that expression.

Ex. Use the order of operations to evaluate the expression:

ⓐ $6 \div (8x - 3)$ [for $x = 0.5$]

$= 6 \div (8 \times 0.5 - 3)$

$= 6 \div (4 - 3)$

$= 6 \div 1$

$= 6$

ⓑ $9 + (p^2 - 3) \div 2$ [for $p = 5$]

$= 9 + (5^2 - 3) \div 2$

$= 9 + (25 - 3) \div 2$

$= 9 + 22 \div 2$

$= 9 + 11 = 20$

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Equivalent Algebraic Expressions

- Algebraic expressions are equivalent if they represent the same value for every value of the variable(s).

Ex. Evaluate each of the following expressions using two different positive integers of your choice. If the expressions are equal, answer yes. If they are not equal, answer no.

a

	$x + 2x$	$2(x + 2)$	Equal or Not?
If $x = 1$	$1 + 2 \times 1$ $= 1 + 2 = 3$	$2 \times (1 + 2)$ $= 2 \times 3 = 6$	No
If $x = 2$	$2 + 2 \times 2$ $= 2 + 4 = 6$	$2 \times (2 + 2)$ $= 2 \times 4 = 8$	No

From the previous table, we find that:

- The two algebraic expressions "$x + 2x$" and "$2(x + 2)$" are not always equal. **So,** they are not equivalent.

---

b

	$6x + 3$	$3(2x + 1)$	Equal or Not?
If $x = 3$	$6 \times 3 + 3$ $= 18 + 3$ $= 21$	$3 \times (2 \times 3 + 1)$ $= 3 \times (6 + 1)$ $= 3 \times 7 = 21$	Yes
If $x = 4$	$6 \times 4 + 3$ $= 24 + 3$ $= 27$	$3 \times (2 \times 4 + 1)$ $= 3 \times (8 + 1)$ $= 3 \times 9 = 27$	Yes

From the previous table, we find that:

- The two algebraic expressions "$6x + 3$" and "$3(2x + 1)$" are always equal. **So,** they are equivalent.

c

	$3x - 2$	$3 - (x + 1)$	Equal or Not?
If $x = 1$	$3 \times 1 - 2$ $= 3 - 2 = 1$	$3 - (1 + 1)$ $= 3 - 2 = 1$	Yes
If $x = 2$	$3 \times 2 - 2$ $= 6 - 2 = 4$	$3 - (2 + 1)$ $= 3 - 3 = 0$	No

From the previous table, we find that:

- The two algebraic expressions "$3x - 2$" and "$3 - (x + 1)$" are not always equal. **So,** they are not equivalent.

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Exercises on lessons 5 to 7

1 Write the algebraic expression that represents each of the following situations:

ⓐ If the price of one pen is 8 pounds, what is the price of "x" pens?

(..............................)

ⓑ If the price of a juice can is 12 pounds, what is the price of "y" juice cans?

(..............................)

ⓒ Salah saves "z" pounds per day. How much does he save in a week?

(..............................)

ⓓ A restaurant provides meals, the price of one meal is 50 pounds, and 15 pounds are added to the home delivery service, regardless of the number of meals required.

What is the total amount paid when ordering "m" meals?

(..............................)

ⓔ Hussam is training for n hours daily for 6 days of the week, and on Friday he is training for 3 hours. How many hours does Hossam spend training in one week? ....

ⓕ Wafaa has 300 pounds. She bought 9 pens of the same type. The price of one pen is "p" pounds. What is the amount left with Wafaa after buying the pens? ....

ⓖ Hana has 3 boxes of pens, each with "q" pens, and she wants to divide these pens among 6 children.

How many pens will each child get? ....

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2 Find the value of the algebraic expression in each of the following

ⓐ $6x + 15$ [If $x = 3$]

= ....

= ....

= ....

ⓑ $25 - 3y$ [If $y = 8$]

= ....

= ....

= ....

ⓒ $9z - 15$ [If $z = 2.1$]

= ....

= ....

= ....

ⓓ $4a - 15 \div 3$ [If $a = 2.5$]

= ....

= ....

= ....

ⓔ $(6b - 3) \div 7$ [If $b = 4$]

= ....

= ....

= ....

ⓕ $18 \div (9 - 2c)$ [If $c = 1.5$]

= ....

= ....

= ....

3 Find the value of the algebraic expression in each of the following

ⓐ $d^3 + 7$ [If $d = 3$]

= ....

= ....

= ....

ⓑ $37 - 4^e$ [If $e = 2$]

= ....

= ....

= ....

ⓒ $f^5 - 21$ [If $f = 2$]

= ....

= ....

= ....

ⓓ $g^2 - 32 \div 8$ [If $g = 5$]

= ....

= ....

= ....

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ⓔ $(h^2 - 1) \div 5$ [If h = 6]

= ....

= ....

= ....

ⓕ $16 \div (20 - n^2)$ [If c = 4]

= ....

= ....

= ....

ⓖ $m^2 + m^3 - 15$ [If m = 3]

= ....

= ....

= ....

ⓗ $k^2 \times (k - 5)$ [If k = 5]

= ....

= ....

= ....

4 Find the value of the algebraic expression in each of the following:

ⓐ $15 + 3x - x^2$ [If x = 4]

= ....

= ....

= ....

ⓑ $y^3 - 5y \div 3$ [y = 3]

= ....

= ....

= ....

ⓒ $6a + (a^2 - 10)$ [If a = 5]

= ....

= ....

= ....

ⓓ $3b + 6 \times (b^2 - 3)$ [If b = 2]

= ....

= ....

= ....

5 In a car park, 10 pounds is collected for parking the car for the first hour, and 5 pounds are added for every hour after the first hour.

ⓐ Write an algebraic expression that expresses the amount collected for parking the car for "h" hours after the first hour. (..)

ⓑ If the number of hours the car waited for is 6 hours, what is the value of the amount collected for parking the car? ....

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6 **Hala receives a daily wage of "p" pounds. If her expenses in 10 days amounted to 325 pounds.**

(a) Write an algebraic expression for the amount remaining with her in the 10 days. (..........)

(b) If Hala's wages are 50 Egyptian pounds per day, how much money is left with her? ....

7 **Evaluate each of these algebraic expressions using two positive integers of your choice. If the algebraic expressions are equal, answer yes. If algebraic expressions are not equal, answer no.**

(a)	$x + 3x$	$3(x + 1)$	Equal or Not?
If x = ...			
If x = ...			

From the previous table, we find that: The two algebraic expressions are .... (equivalent or not equivalent).

(b)	$5x + 5$	$5(x + 1)$	Equal or Not?
If x = ...			
If x = ...			

From the previous table, we find that: The two algebraic expressions are .... (equivalent or not equivalent).

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ⓒ	$8x - 4$	$4x + 3 + 4x + 1$	Equal or Not?
If x = ...			
If x = ...			

From the previous table, we find that: The two algebraic expressions are .... (equivalent or not equivalent).

ⓓ	$2x + 3x + 10$	$5(x + 2)$	Equal or Not?
If x = ...			
If x = ...			

From the previous table, we find that: The two algebraic expressions are .... (equivalent or not equivalent)

ⓔ	$9(x + 6)$	$9x + 6$	Equal or Not?
If x = ...			
If x = ...			

From the previous table, we find that: The two algebraic expressions are .... (equivalent or not equivalent)

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Quiz

$\frac{\quad}{10}$

1 Complete the following:

ⓐ If the price of one pen is 9 pounds, what is the price of k pens?

ⓑ Lojy saves z pounds per day. Then, she saves pounds in a week.

ⓒ The value of the expression $2x$ (when x = 7) is .

ⓓ "$2x + 3x + 10$" and "$4(x + 3)$" are equal when $x =$.

2 Match:

ⓐ The value of $b^3 - 4b \div 2$ [when $b = 2$] is •	• 7	1
ⓑ The value of $x^2 + x^3 - 10$ [If $x = 2$] is •	• 4	2
ⓒ The value of $(y^2 - 1) \div 5$ [If $y = 6$] is •	• 2	3

3 Choose the correct answer:

ⓐ $3a + 7 = 25$ when $a =$ .... (5 or 6 or 7 or 8)

ⓑ $c^3 + 1 = 9$ when $c =$ .... (1 or 5 or 8 or 2)

ⓒ $4y - 10 = 14$ when $y =$ .... (6 or 5 or 8 or 2)

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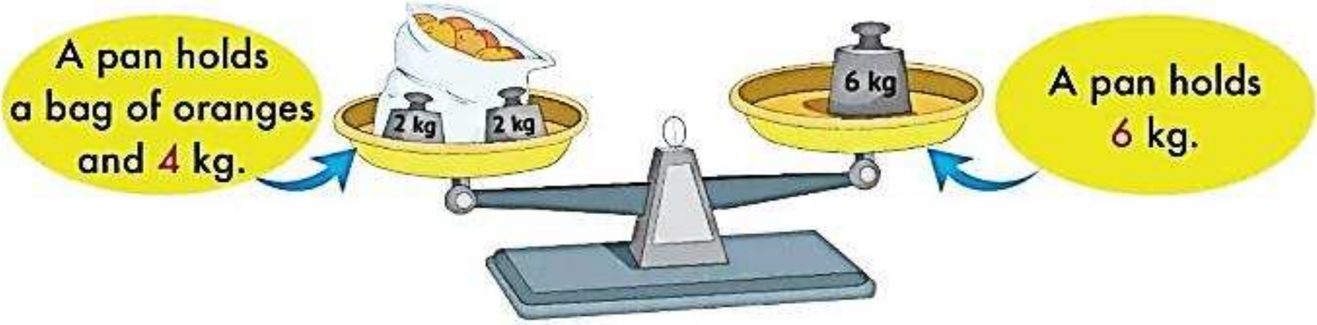
Unit 4 Lesson 1

Solving Algebraic Equations

Explaining

The Concept of Equation

The following figure shows a scale with two pans.



- If we denote the mass of the bag of oranges as "x" kilograms.

So, the total mass on the left side is ($x + 4$) kilograms.

- The mass of the two pans is equal when

$x + 4 = 6$ or when $x = 2$.

- This means that the mass of the two pans is equal when the mass of the orange bag is 2 kg.

Important Notes:

- $x + 4 = 6$, x is called an equation.
- The letter "x" is called "unknown" or "variable".
- The number "2" is called the solution to the equation (The value of x).

- **The equation:** Is a mathematical sentence that includes an equal relationship between two mathematical expressions.
- The equation has two sides with an (=) sign between them.
- Solving equation: means finding the value of the (unknown) variable.

Examples on the equations:

$x + 3 = 8$, $x - 6 = 2$, $3x = 12$, $\frac{x}{3} = 5$

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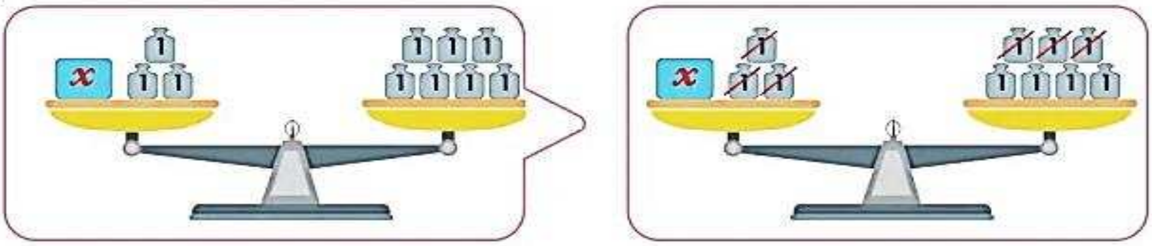
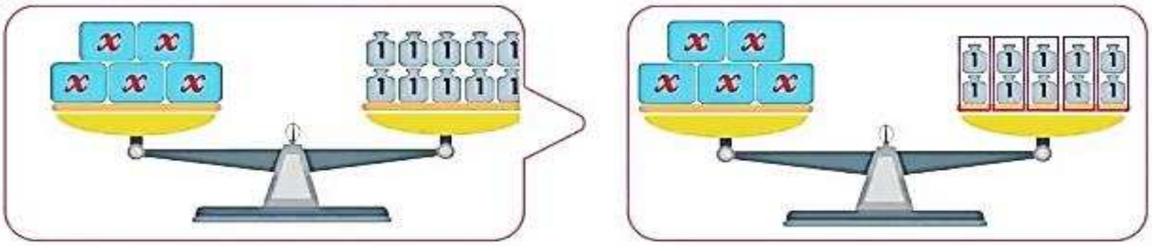
Ex. Write the equation that represents each of the following models, then find the value of "x":

ⓐ



Equation: $x + 3 = 7$ → $x = 4$

ⓑ



Equation: $5x = 10$ → $x = 2$

Solve Equations

- **Adding** equal amounts to both sides of the equation doesn't affect equality.

Ex. $b - 3 = 4$

By adding 3 to both sides of the equation

$b - \cancel{3} + \cancel{3} = 4 + 3$

$b = 7$

- **Subtracting** equal amounts from both sides of the equation doesn't affect equality.

Ex. $a + 5 = 9$

By subtracting 5 from both sides of the equation

$a + \cancel{5} - \cancel{5} = 9 - 5$

$a = 4$

- **Dividing** both sides of the equation by the same number (not equal to zero) doesn't affect equality.

Ex. $5m = 15$

By dividing both sides of the equation by 5,

$\frac{\cancel{5}m}{\cancel{5}} = \frac{15}{5}$

$m = 3$

- **Multiplying** both sides of the equation by the same number (not equal to zero) doesn't affect equality.

Ex. $\frac{1}{3}n = 2$

By multiply both sides of the equation by 3,

$\frac{1}{\cancel{3}}n \times \cancel{3} = 2 \times 3$

$n = 6$

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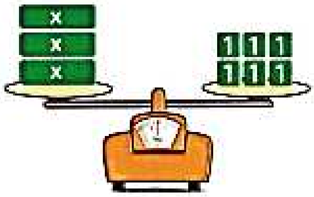
Exercises on lesson 1

1. In each of the following figures , the two pans of the scale are balanced, write the equation and solve it.

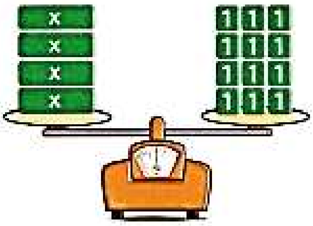
a.



Equation : ______________

Solution : ______________

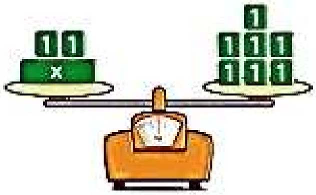
b.



Equation : ______________

Solution : ______________

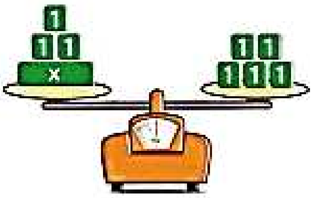
c.



Equation : ______________

Solution : ______________

d.



Equation : ______________

Solution : ______________

2. Solve each of the following equations.

a. $x + 3 = 12$

____

____

b. $x + 8 = 15$

____

____

c. $x - 7 = 25$

____

____

d. $y - 5 = 7$

____

____

e. $8 + z = 8$

____

____

f. $9 + y = 44$

____

____

g. $3x = 27$

____

____

h. $4x = 16$

____

____

i. $37y = 37$

____

____

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j. $5a = 0$

k. $\frac{x}{6} = 12$

l. $y \div 5 = 1$

m. $70 = 50 + t$

n. $16 = n - 3$

o. $48 = 4y$

3. Complete the following.

a. If $x + 5 = 11$, then $x =$ ……

b. If $6y = 18$, then $5y =$ ……

c. In the equation $m - 4 = 11$, the value of m is ……

d. The solution of the equation : $z \times 12 = 84$ is ……

e. If $k \div 4 = 7$, then $k =$ ……

f. If $96 \div y = 12$, then $\frac{1}{2}y =$ ……

g. If $\frac{x}{3} = 4$, then twice $x =$ ……

h. If $k + 1 = 5$, then $k - 3 =$ ……

i. If $m - 3^2 = 1$, then $m =$ ……

j. The number of solutions of the equation : $4 - x = 1$ is/are …… solution (s).

k. If $x + x = 16$, then $x - 3 =$ ……

l. If $x + \frac{1}{2} = 3$, then $x =$ ……

m. If $\frac{1}{2}x = \frac{2}{3}$, then $\frac{1}{3}x =$ ……

4. **Model and Solve** Complete these three tasks.

a. Explain the difference in modeling these two equations on a pan balance.

$$3x = 9 \text{ and } x + 8 = 17$$

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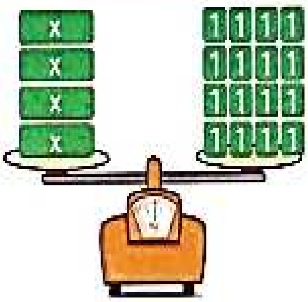
b. Explain how you would use the balance to find x for the equation $3 + x = 12$

c. Explain how you would use the balance to find x for the equation $6x = 18$

5. Write an Equation and Solve Answer the following questions.



a. Write an equation for the opposite model.
Explain how you wrote the equation.

b. Solve the equation. How do you know that you solved the equation correctly ?

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Quiz

$\overline{\quad\quad}$
10

1 Find the value of the variable in each of the following equations (solve the equation)

ⓐ $X + 2 = 11$

= ....

= ....

ⓑ $m - 7 = 9$

= ....

= ....

ⓒ $5y = 45$

= ....

= ....

ⓓ $\frac{k}{8} = 6$

= ....

= ....

2 Choose the correct answer:

ⓐ If $m + 7 = 25$, then $m =$ .... (7 or 10 or 18 or 20)

ⓑ If $k = 10$, then $k -$ .... $= 4$. (10 or 4 or 2 or 6)

ⓒ If $3f = 27$, then $f =$ .... (8 or 9 or 7 or 4)

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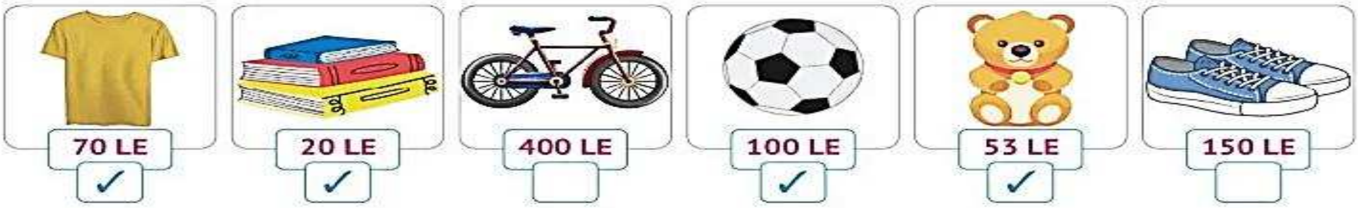
Unit 4

Lessons 2 and 3

Exploring Inequalities
Solving Inequalities

Explaining

EX. If Farida has 100 pounds, what can she choose from the following?



So, the price of items should be less than or equal to 100 pounds.

Inequality

- Is a mathematical relationship that compares the value of two mathematical expressions by using the signs of the inequality.

Signs of the inequality

	>	<	≥	≤
is read as:	Greater than	Less than	Greater than or equal to	Less than or equal to

Solving Inequalities by Using a Number Line

The Solution of the Inequality

- Is to find the values of the variable (unknown) that make the inequality relation true.

Representing Inequalities on a Number Line

- All integers are represented only by dots at these numbers, which connect them with a line that extends without limit.

If "a" is an integer and it is represented on the number line then:

All numbers to the left of "a" are less than it

All numbers to the right of "a" are greater than it

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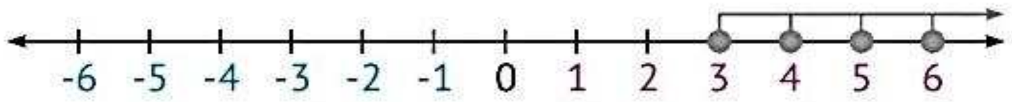
For example:

a $x > 2$ **is read as** x is greater than 2.

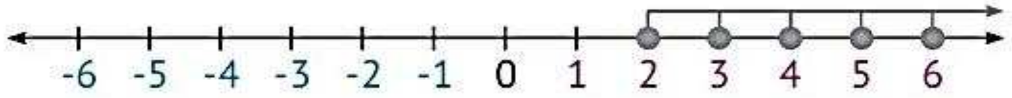


- The set of values that satisfy the inequality is 3 , 4 , 5 , 6 , 7 , 8...

(All integers are greater than 2)

---

b $x \geq 2$ **is read as** x is greater than or equal to 2.

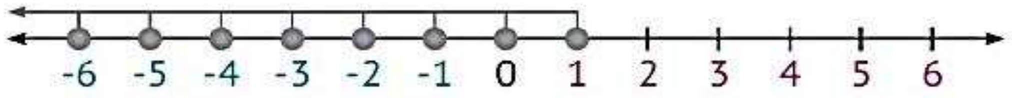


- The set of values that satisfy the inequality is 2 , 3 , 4 , 5 , 6 , 7 , 8...

(All integers are greater than or equal to 2)

---

c $x < 2$ **is read as** x is less than 2.

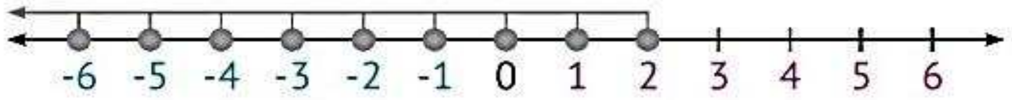


- The set of values that satisfy the inequality is 1 , 0 , -1 , -2 , -3 , -4 , -5...

(All integers are less than 2)

---

d $x \leq 2$ **is read as** x is less than or equal to 2.



- The set of values that satisfy the inequality is 2 , 1 , 0 , -1 , -2 , -3 , -4 , -5...

(All integers are less than or equal to 2)

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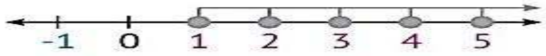
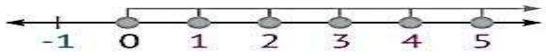
Important Notes:

- The sets of numbers can be represented as the following:

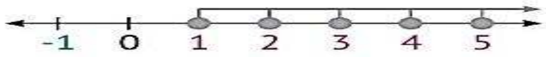
The set of counting numbers
$X \geq 1$ or $X > 0$



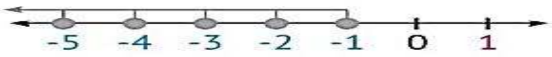
The set of natural numbers
$X \geq 0$ or $X > -1$



The set of positive integer
$X > 0$ or $X \geq 1$



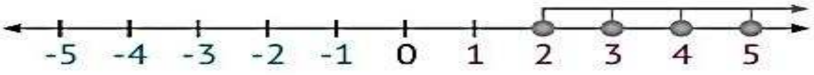
The set of negative integer
$X < 0$ or $X \leq -1$



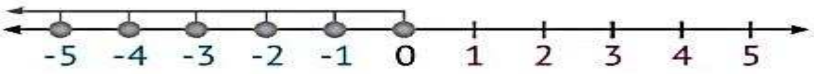
Ex.

- The representation of the inequalities $x > 1$, and $x < 1$ on the number line (where x is an integer)

$x > 1$



$x < 1$



The two inequalities are similar in:

- The number 1 does not belong to the solution set in each of them.

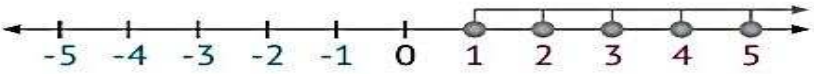
The two inequalities differ in:

- Each of them represents the values in two opposite directions from the number 1.
- They have no common points.

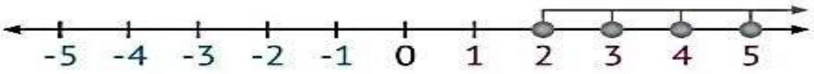
Ex.

- The representation of the inequalities "$x \geq 1$", and "$x > 1$" on the number line of the inequalities (where x is an integer number).

$x \geq 1$



$x > 1$



The two inequalities are similar in:

- Each of them represents the values to the right of the number 1.
- There are many common points between them.

The two inequalities differ in:

- The number 1 does not belong to the solution set in the inequality "$x > 1$".
- The number 1 belongs to the solution set in the inequality "$x \geq 1$"..

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Exercises on lessons 2 and 3

1 Write the inequality that represents each of the following expressions:

ⓐ All values greater than –1: ....

ⓑ All values less than 2: ....

ⓒ All values to the right of –9 on the number line are: ....

ⓓ All values to the left of the number 2 on the number line are: ....

ⓔ All values greater than or equal to 6: ....

ⓕ All values less than or equal to –8: ....

ⓖ 4 and All values to the left of the number 4 on the number line: ....

ⓗ –2 and All values to the right of –2 on the number: ....

ⓘ Negative integers: .... (Where x is an integer.)

ⓙ Positive integers: .... (Where x is an integer.)

ⓚ Natural numbers: .... (Where x is an integer.)

ⓛ Counting numbers: .... (Where x is an integer.)

ⓜ Non-negative integers: .... (Where x is an integer.)

ⓝ Non-positive integers: .... (Where x is an integer.)

2 Write what each of the following inequalities represents:

ⓐ $x > 9$ all values ....

ⓑ $x > -5$ all values ....

ⓒ $x < 2$ all values ....

ⓓ $x < -7$ all values ....

ⓔ $x \leq -3$ all values ....

ⓕ $x \leq 4$ all values ....

ⓖ $x \geq 3$ all values ....

ⓗ $x \geq 0$ all values ....

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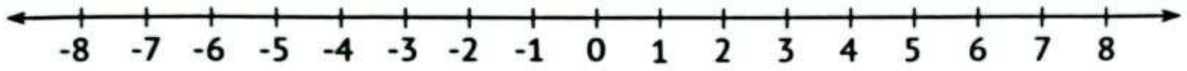
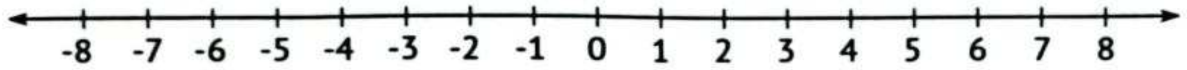
3 Use the number line to represent each of the following inequalities

Where "x" is an integer:

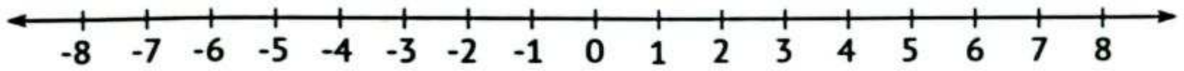
ⓐ $x > -1$



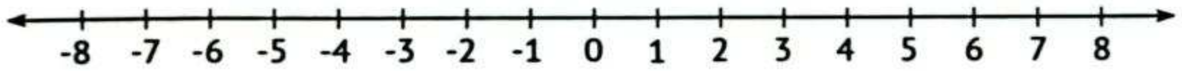
ⓑ $x \geqslant -1$



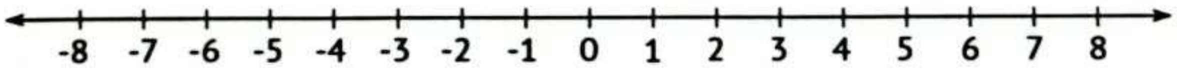
ⓒ $x < 2$



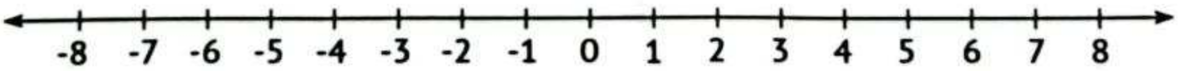
ⓓ $x \leqslant 2$



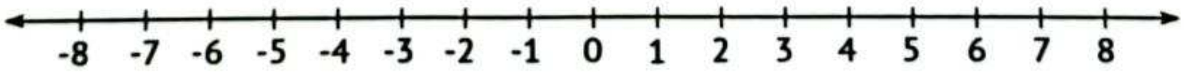
ⓔ $x > 3$



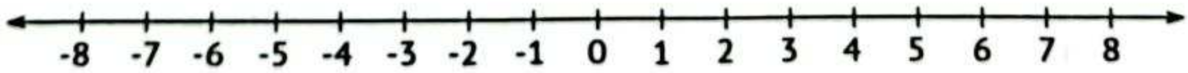
ⓕ $x \geqslant 3$



ⓖ $x < 0$



ⓗ $x \leqslant 0$



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4 Choose the correct answer:

a The inequality that represents all values greater than – 1 is ....

($x > -1$ or $x < -1$ or $x \leq -1$ or $x \geq -1$)

b The inequality that represents all values to the left of 5 on a number line is ....

($x > 5$ or $x < 5$ or $x \leq 5$ or $x \geq 5$)

c The inequality that represents all values less than or equal to – 7 is ..... .

($x > -7$ or $x < -7$ or $x \leq -7$ or $x \geq -7$)

d The inequality that represents 3 and all the values to the right of 3 on the number line is ....

($x > 3$ or $x < 3$ or $x \leq 3$ or $x \geq 3$)

e The inequality that represents negative integers are .... (where x is an integer).

($x > 0$ or $x < 0$ or $x \leq 0$ or $x \geq 0$)

f The inequality that represents non-positive integers .... (where x is an integer)

($x > 0$ or $x < 0$ or $x \leq 0$ or $x \geq 0$)

g The graph of the inequalities $x > 3$ and $x < 3$ on a number line are similar in ....

(3 does not belong to the solution set in each of them
or both include all values to the left of 3
or there is a common point between them
or each of them includes all the values to the right of 3)

h The graph of the inequalities $x < 4$ and $x \leq 4$ on a number line are similar in ....

(4 does not belong to the solution set in each of them
or each including all values to the left of 4
or there is a common point between them
or each of them includes all the values to the right of the number 4)

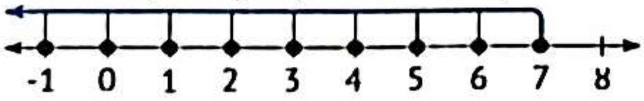
i Which of the following values is a solution to the inequality $x < 9$?

(10 or 9.1 or –9.5 or 9)

j Which of the following values is a solution to the inequality $x \geq 5$?

(–5 or 4.59 or –25 or 6)

k The inequality represented by the corresponding graph is: ....



($x > 7$ or $x < 7$ or $x \leq 7$ or $x \geq 7$)

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5 How similar are the graphs of the following pair of algebraic expressions? And what is the difference:

a $x < -8$, $x \leq -8$

① The similarity

....
....
....

② The differences

....
....
....

b $x \geq -8$, $x \leq -8$

① The similarity

....
....
....

② The differences

....
....
....

c $x = -8$, $x > -8$

① The similarity

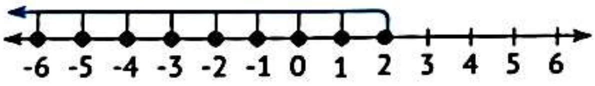
....
....
....

② The differences

....
....
....

6 Write the inequality represented by each of the following number lines:

a



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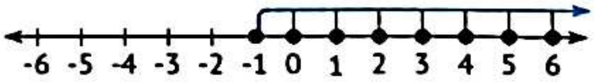
b



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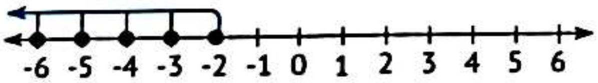
c



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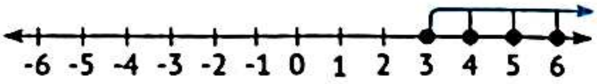
d



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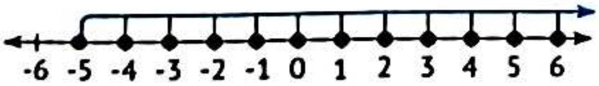
e



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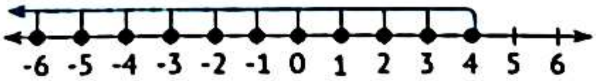
f



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Quiz

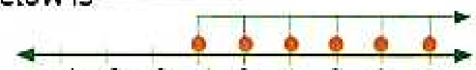
/ 10

Choose the correct answer.

1. Which of the following is a solution of the inequality $m \geq -1$?
   A. -2 B. -3
   C. -4 D. 0

2. All of the following are solutions of the inequality $m < -3$ except ______
   A. -6 B. -10
   C. -2 D. -5

3. The inequality that represents the graph below is ______

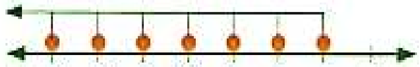


   A. $k > -1$ B. $k \geq -1$
   C. $k < -1$ D. $k \leq -1$

4. Number of solutions of inequality $x > 10$ is ______
   A. 0 B. 1
   C. 2 D. infinite

5. ______ is a solution of $x < 4$
   A. 3.96 B. 4
   C. 4.24 D. 5

6. The inequality that represents the following graph is ______



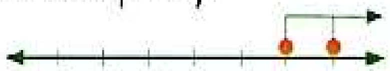
   A. $m > 3$ B. $m \geq 3$
   C. $m < 3$ D. $m \leq 3$

7. Ali has 2 pets, Adam has more pets than Ali, then Adam may has ______ pets.
   A. 2 B. 1
   C. 3 D. 0

8. Mostafa can fit no more than 12 books in the box, then the inequality which represents the number of books that Mostafa can fit in the box is ______
   A. $n \geq 12$ B. $n < 12$
   C. $n \leq 12$ D. $n > 12$

9. Which of the following is NOT a solution of $n > 1.5$?
   A. 2.5 B. 2
   C. 3.5 D. 1

10. ______ is a solution of the following graphed inequality.



   A. -10 B. 0
   C. 1 D. 10

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Unit 5
Lessons 1 and 2

- The Relation between Dependent and Independent Variables
- Applications on Dependent and Independent Variables

Explaining

Dependent and Independent Variables

Variable

Independent Variable

- It's a variable whose value is not determined by any other value or variable.
- Therefore, any value can be assigned to it.

Dependent Variable

- It's an outcome variable that is determined by or based on the other variable (independent) as the input.

Ex. If the price of one pen is 5 pounds, then the price of:

2 pens:	5	X	2	=	10	pounds
3 pens:	5	X	3	=	15	pounds
4 pens:	5	X	4	=	20	pounds
5 pens:	5	X	5	=	25	pounds

Constant (the column of 5s) — Independent Variable (the number of pens) — Dependent Variable (the price in pounds)

- The price of the pen is **constant**.
- The number of purchased pens is a variable **(an independent variable)**.
- The total purchase price of any number of pens is a variable **(a dependent variable)**.
- The total purchase price of pens depends on the number of pens purchased. As the number of pens changes, the total price of pens also changes.

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- If we denote the number of pens by the symbol x and the total purchase price by the symbol y, the equation that represents the relationship between the number of pens and the total purchase price is:

Variable y is called A dependent variable

$$y = 5x$$

Variable x is called an independent variable

- The independent variable is usually denoted by "x" and the dependent variable is denoted by "y".
- Other symbols may be used.

Ex. The price of one kilogram of bananas is 9 pounds, and the price of x kilograms of bananas is y pounds.

(a) The equation that represents the relationship between the weight of bananas "x" and the purchase price "y" is $y = 9x$.

(b) The independent variable is "x".

(c) The dependent variable is "y".

(d) The price of 5 kilograms of bananas is 9 X 5 = 45 pounds.

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Exercises on lessons 1 and 2

1 Determine the independent variable and the dependent variable in each of the following situations:

a	The money you spend Independent Dependent	and	The types of games you like Independent Dependent
b	The menu Independent Dependent	and	What you order from the food stall Independent Dependent
c	How much you laughed Independent Dependent	and	How funny the joke was Independent Dependent
d	The number of cars in the garage Independent Dependent	and	The area of the garage Independent Dependent
e	The number of students participating in the trip Independent Dependent	and	The number of supervisors Independent Dependent
f	The number of days of going to the club Independent Dependent	and	The number of training hours Independent Dependent
g	The amount of food you eat Independent Dependent	and	The amount of weight gain Independent Dependent
h	The speed of the vehicle Independent Dependent	and	The distance traveled in one hour Independent Dependent
i	The money you have Independent Dependent	and	The number of pens you can buy Independent Dependent

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2 Determine the independent variable and the dependent variable in each of the following relationships:

Relationship	$e = 8 - r$	$\frac{s}{3} = b$	$z + 5 = m$	$y = 5x$
Independent Variable				
Dependent Variable				

Relationship	$2a = b$	$F = t + 4$	$p - 3 = z$	$3m = w$
Independent Variable				
Dependent Variable				

3 The price of one pen is 9 pounds. Complete:

a The equation represents the relationship between the number of pens (x) and the purchase price (y) is: ....

b The independent variable is ....

c The dependent variable is ....

d The price of 6 pens is: ....

4 15 pounds will be added for the delivery of fast food meals in a restaurant. Complete:

a The equation represents the relationship between the price of meals (x) and the amount to be paid, including delivery (y).

is: ....

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ⓑ The independent variable is ....

ⓒ The dependent variable is ....

ⓓ The required amount if the price of meals is 120 pounds is ....

5 Hazem owns a discount card of 50 pounds. Complete :

ⓐ The equation represents the relationship between Hazem's purchases amounted (x) pounds, the amount to be paid after the discount (y) pounds is ....

ⓑ The independent variable is ....

ⓒ The dependent variable is ....

ⓓ The required amount if the purchase price before the discount is 420 pounds: ....

6 Speed of a car = Distance ÷ Time. If the time is 3 hours.

ⓐ The equation represents the relationship between distance (x) and speed (y) is ....

ⓑ The independent variable is ....

ⓒ The dependent variable is ....

ⓓ Calculate the speed in each of the following cases, such that the time is constant (3 hours):

Distance (km)	420	360	270	210	180
Speed (km per hour)	....	....	....	....	....

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Quiz

8

Choose the correct answer.

1. In the equation : $x = 4y + 3$ the dependent variable is ______
   A. x B. 4
   C. y D. 3

2. In the equation : $9a + 24 = b$ the independent variable is ______
   A. 9 B. a
   C. 24 D. b

3. "8 more than s equals t" in equation is ______
   A. $8s = t$ B. $8t = 8$
   C. $8 + s = t$ D. $8 + t = s$

4. "m equals the product of n and 3" in equation is ______
   A. $m = 3n$ B. $m = 3 + n$
   C. $n = 3m$ D. $n = 3 + m$

5. "4 times l added to 7 equals k" in equation is ______
   A. $7l + 4 = k$ B. $7k + 4 = l$
   C. $4l + 7 = k$ D. $4k + 7 = l$

6. "f equals the sum of adding 11 to the product of 8 and e" in equation is ______
   A. $e = 8 + 11f$ B. $e = 11 + 8f$
   C. $f = 8 + 11e$ D. $f = 11 + 8e$

7. The word phrase for the equation "$g = 9h$" is ______
   A. h equals g increased by 9 B. g equals 9 times h
   C. h equals 9 times g D. g equals h increased by 9

8. In the opposite table; the equation which using the variables r and t of swing where r is the number of rides and t is the total number of tickets is ______
   A. $r = 8t$ B. $r = 11t$
   C. $t = 8r$ D. $t = 11r$

Ride	Number of Tickets
Swing	11 Tickets
Viking	8 Tickets

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Unit 5

Lessons 3 and 4

- Analyzing the Relationship between Dependent and Independent Variables
- Graph Representation for Dependent and Independent Variables

Explaining

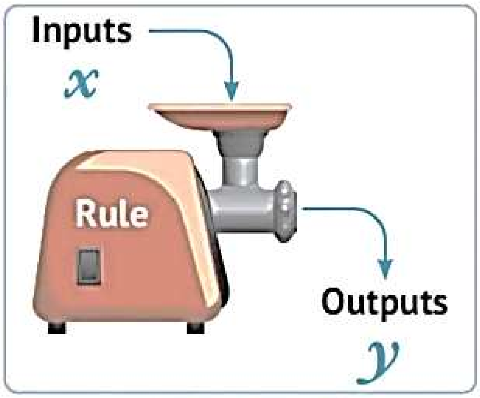
Rules, Variables, and Equations - Inputs/Outputs

- If the average number of books a person reads per month is 4, note the following table:

Number of Months	1	2	3	4	5	6	x
Number of Books	4	8	12	16	20	24	y

(X4)

Number of Monthes → Independent Variable → The input number → x Represents the input numbers



$4x = y$ Equation

Number of Books → Dependent Variable → The output number → y Represents the output numbers

Important Notes:

- The input number → Is the independent variable.
- The output number → Is the dependent variable.
- The rule → Is the relationship between the independent variable and the dependent variable.

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Ex.

Rule	Equation
Multiply by 3	$y = 3x$
Add 5	$y = x + 5$
Divide by 8	$y = x \div 8$
Subtract 7	$y = x - 7$
Multiply by 5, then subtract 2	$y = 5x - 2$
Add 3, then divide by 7	$y = (x + 3) \div 7$

Note:
- When adding or subtracting before division or multiplication, you must use **parentheses**.

Finding the Rule and Equation from the Table

- You can't always know the correct rule for a pattern with one input and one output. You may need more than one input and output.

Ex. Notice the following patterns:

ⓐ

Inputs (x)	1	3	5	7
Outputs (y)	4	6	8	10

- **Rule:** Add 3
- **Equation:** $y = x + 3$

ⓑ

Inputs (x)	8	16	24	32
Outputs (y)	2	4	6	8

- **Rule:** Divide by 4
- **Equation:** $y = x \div 4$

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- A pattern rule can consist of more than one operation.

Ex. Notice the following patterns:

ⓐ

x	3	5	7	8
y	10	16	22	25

- **Rule:** Multiply by 3, then add 1.
- **Equation:** $y = 3x + 1$

ⓑ

x	5	9	13	21
y	2	4	6	10

- **The rule:** Subtract 1, then divide by 2.
- **Equation:** $y = (x - 1) \div 2$

Representing the Dependent and Independent Variables

To represent the independent and dependent variables on a coordinate plane as a graph:

- Put the independent (input) variable on the x-axis (horizontally).
- Put the dependent (output) variable on the y-axis (vertically).

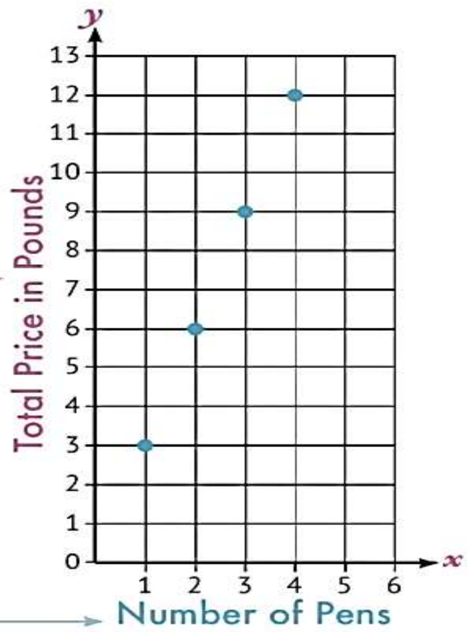
Ex. The following table represents the number of pens and their total price:

Number of Pens (x)	1	2	3	4
Total Price in Pounds (y)	3	6	9	12
• Points (x, y) →	(1, 3)	(2, 6)	(3, 9)	(4, 12)

The equation that represents the relationship between the variables x and y is ($y = 3x$)

(Vertically) Total price in pounds (dependent variable) is represented on the y-axis.

The number of pens (independent variable) is represented on the x-axis. (Horizontally)



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Exercises on lessons 3 and 4

1. Evaluate each of the following for $x = 2$

a. $y = 2x$

b. $y = x + 3$

c. $y = x + \frac{1}{4}$

d. $y = x + 8.5$

e. $y = 4x + 5$

f. $y = 2x + \frac{3}{4}$

g. $y = 5x + 35$

h. $y = 7x + 7.19$

---

2. Write an equation. Use the variables x and y , where x is the independent variable to evaluate y

a. The equation "Multiply by 5" , substitute if $x = 7$

b. The equation "Add 1" , substitute if $x = 5.2$

c. The equation "Multiply by 4 and add 3" , substitute if $x = 3.3$

d. The equation "Multiply by 5 and add 4.1" , substitute if $x = 8$

---

3. **Show what you learned.** Complete each statement, using the variables x and y as needed.

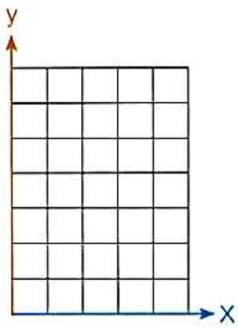
- If the rule is "Multiply by 2" , you would write the equation as : [A] ______
  So, if $x = 2.3$, then y would be : [B] ______
- If the rule is "Add 6" , the equation is : [C] ______
  So, if x is $\frac{1}{4}$, then y would be : [D] ______

---

4. Complete the following tables, then make the graphs.

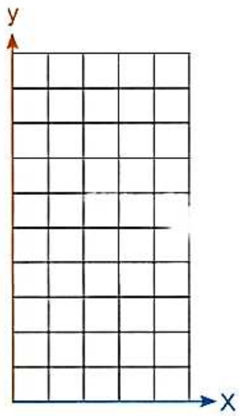
a. The equation : $y = x + 1$

x	0	1	2
y	______	______	______
(x , y)	(0 , ___)	(1 , ___)	(2 , ___)



b. The equation : $y = 2x$

x	1	3	5
y	______	______	______
(x , y)	______	______	______



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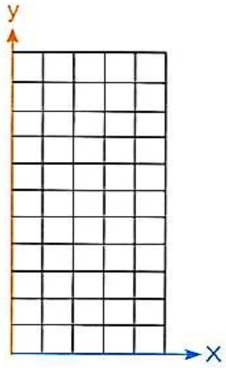
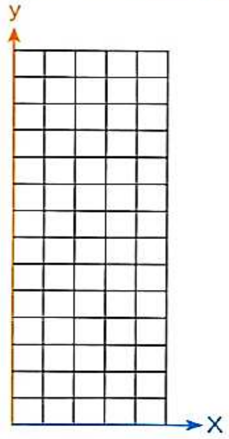
c. The equation : $y = 2x + 1$

x	0	2	3	5
y				
(x , y)				



d. The equation : $y = 2 + 3x$

x	1	2	3	4
y				
(x , y)				



5. Equation from a table. Use variables x and y to write the equation for each of the tables.

a.

x	0	4	8	12
y	4	8	12	16

b.

x	12	20	8	4
y	7	11	5	3

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Quiz

$\frac{\quad}{10}$

Choose the correct answer.

1. In the equation : $y = 2 + x$, if $x = 3$, then y would be ......

A. 2 B. 3
C. 4 D. 5

2. In the equation : $y = 3x$, if $x = 5.1$, then y would be ......

A. 8.1 B. 53.1
C. 15.3 D. 18.3

3. The ordered pair which satisfies the equation : $y = x + 1$ is ......

A. (0 , 2) B. (1 , 1)
C. (2 , 1) D. (1 , 2)

4. In the equation : $y = 2x$, y equals 8 where $x =$ ......

A. 2 B. 4
C. 6 D. 8

5. In the equation : $y = 3x + 6.4$, if $x = 1$, then y would be ......

A. 6.4 B. 18.4
C. 19.2 D. 9.4

6. In the equation : $y = \frac{1}{2}x + 1$, if $x = 12$, then y would be ......

A. 7 B. 6
C. 13 D. 6.5

7. If the equation : $y = x + 4$ is represented by the table

x	0	2	3
y	4	a	7

then the letter a equals ......

A. 5 B. 6
C. 8 D. 2

8. The equation which represents the table

x	1	2	3
y	3	5	7

is ......

A. $y = x + 2$ B. $y = 2x$
C. $y = 2x + 1$ D. $y = \frac{x}{2} + 2$

9. In the equation : $y = \frac{1}{3}x$, if the input is 12, then the output is ......

A. 15 B. 9
C. 36 D. 4

10. In the equation : $y = x + \frac{1}{2}$, if the output is $5\frac{1}{2}$, then the input is ......

A. 6 B. 5
C. 22 D. $4\frac{1}{2}$

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Unit 6 Lesson 1

Data and Statistical Questions

Explaining

Statistical Questions and Non-Statistical Questions

- The type of question is determined by the data we get from answering these questions.

Statistical Question

- It's a question for which we have many possible answers.

For example: How old are the students in your class?

It is a statistical question because we expect a change in the ages of the students.

Non-Statistical Question

- It's a question for which we have only one answer.

For example: "How old are you?"

It is a non-statistical question because we expect only one answer.

Types of Statistical Questions

- The type of statistical question is determined by the type of data we get from answering these questions.

A Numerical Statistical Question

Results in numerical (quantitative) data.

It is data written in the form of numbers to express the measurement of a specific phenomenon.

For example: Weight, temperature, height, age, number of working hours, ...

A Categorical Statistical Question

Results in descriptive data.

It is data written in the form of adjectives or words to describe the status of members of society.

For example: Marital status, favorite food, favorite color, place of birth, blood type, ...

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Exercises on lesson 1

1 Select the type of each of the following questions:

(A statistical question or a non-statistical question)

	The question	Statistical	Non-statistical
a	What is your favourite subject?		
b	What is the most favourite color for the class's students?		
c	What is your name?		
d	How many members of your family?		
e	How old are you ?		
f	How many students are there in your school classes?		
g	What is the most favorite sport for the class's students?		
h	Do you practice swimming?		
i	How much money do students spend in a class per day?		
j	What color are the eyes of the students in your class?		

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2 Determine whether the results from each question would give you numerical data or categorical data.

	Question	Numerical Data	Categorical Data
a	How many students' families are in your class?		
b	What is the most favorite sport for the class's students?		
c	What football teams do your students support?		
d	What is the monthly income of the employees of the most profitable companies?		
e	What are the heights of the students in your class?		
f	How many hours did the workers work in your father's factory?		
g	What are the blood groups of the students in your class?		
h	What are the weights of the students in your class?		
i	How many brothers and sisters does each of the students in your class have?		
j	What is the most favourite subject for the students in your class?		

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3 Complete the following:

a) Types of statistical questions are ………… questions and ………… questions.

b) Types of statistical data are ………………… data and ………………… data.

c) ………………… data is written in the form of numbers.

d) ………………… data is written in the form of words.

e) What is your eyes' color? it is a ………………… question, while what color are the eyes of the students in your class? is a ………………… question.

f) Do you like the red color? is a ………………… question, while what are the pupils' favourite colors? is a ………………… question.

g) The monthly income of an institution's employees is a ………………… data.

h) The number of letters in each student's first name is a ………………… data.

i) The types of pens preferred by your class's students is a ………………… data.

j) The types of pets owned by the class's pupils are a ………………… data, while the number of pets owned by the class's pupils, is a ………………… data.

4 Choose the correct answer:

a) A statistical question ………………… .

(results in a lot of different answers or its answer is yes or no or has one answer or its answer is one number)

b) ………………… are categorical data.

(Dates of birth or Ages or Weights or Favorite colors)

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c .... are/is categorical data.

(The number of students in each class or The number of family members or Favorite TV shows or Test scores)

d .... are numerical data.

(Preferred colors or Blood groups or Birthplaces or Ages)

e .... are numerical data.

(Salaries or Favorite sports or Eye colors or Nationalities)

f All of the following are categorical data, except ....

(favourite foods or occupations or weights or eye colors)

g All of the following are categorical data, except ....

(marital statuses or heights or place of birth or skin color)

h All of the following are numerical data, except ....

(temperatures or lengths or names or weights)

i All of the following are numerical data, except ....

(types of pets or test scores or ages or number of pets)

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Quiz

$\frac{\quad}{10}$

1 Complete the following:

ⓐ The types of statistical questions are .... questions and .... questions.

ⓑ The types of statistical data are .... data and .... data.

ⓒ The numerical data is written in the form of ....

ⓓ The categorical data is written in the form of ....

ⓔ "What color are the pupils' eyes in your class?"

is a .... question. (statistical / non-statistical)

2 Choose the correct answer:

ⓐ .... are categorical data.

(Dates of birth or Ages or Weights or Favorite colors)

ⓑ .... are numerical data.

(Salaries or Favorite sports or Eye colors or Nationalities)

ⓒ All following data are categorical data, except ....

(birth places or lengths or names or colors)

ⓓ All the following data are numerical, except ....

(types of pets or test scores or ages or number of pets)

ⓔ "What is your weight?" is a .... question.

(numerical statistical or categorical statistical or non-statistical)

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Unit 6
Lessons 2 and 3

Exploring the Histogram
Representing Data Using Histograms

Explaining

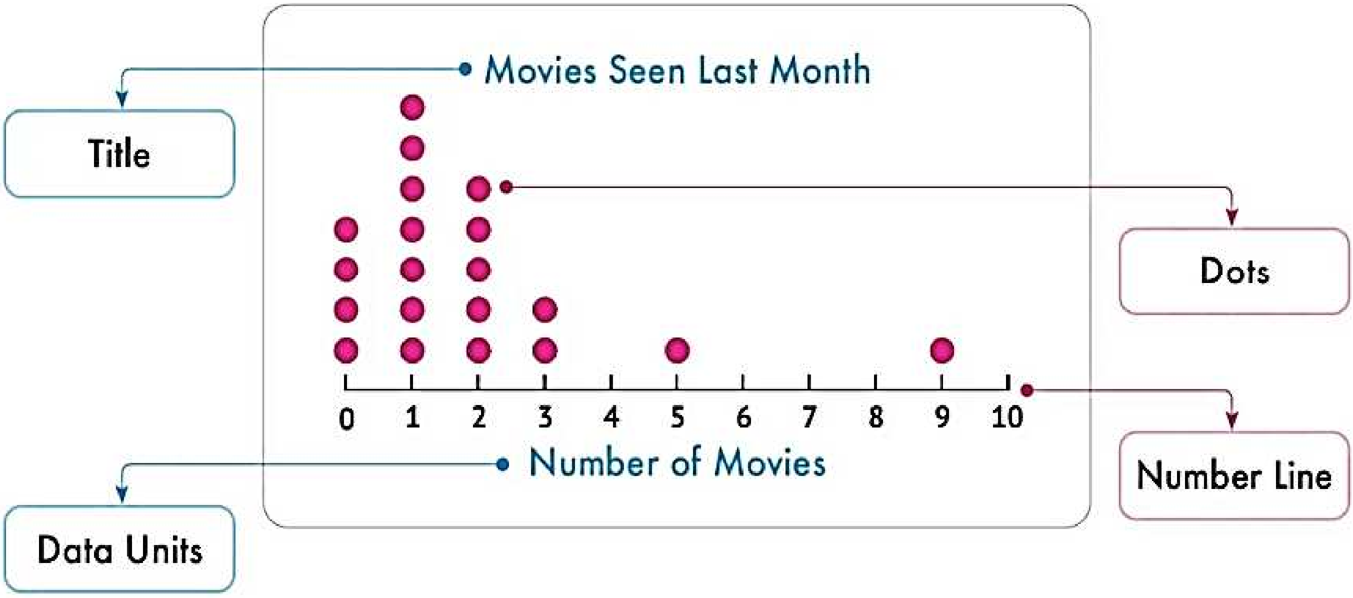
Dot Plots

- It is used to represent repeated numerical data on a horizontal number line.

Characteristics that all dot plots share:

- Titles.
- Data graphed above a number line.
- Each individual piece of data can be seen on a dot plot and is represented by a dot.
- The number lines in dot plots should be labeled with the units used to measure the data.

Ex. The following dot plot represents the number of movies that 20 people watched last month:



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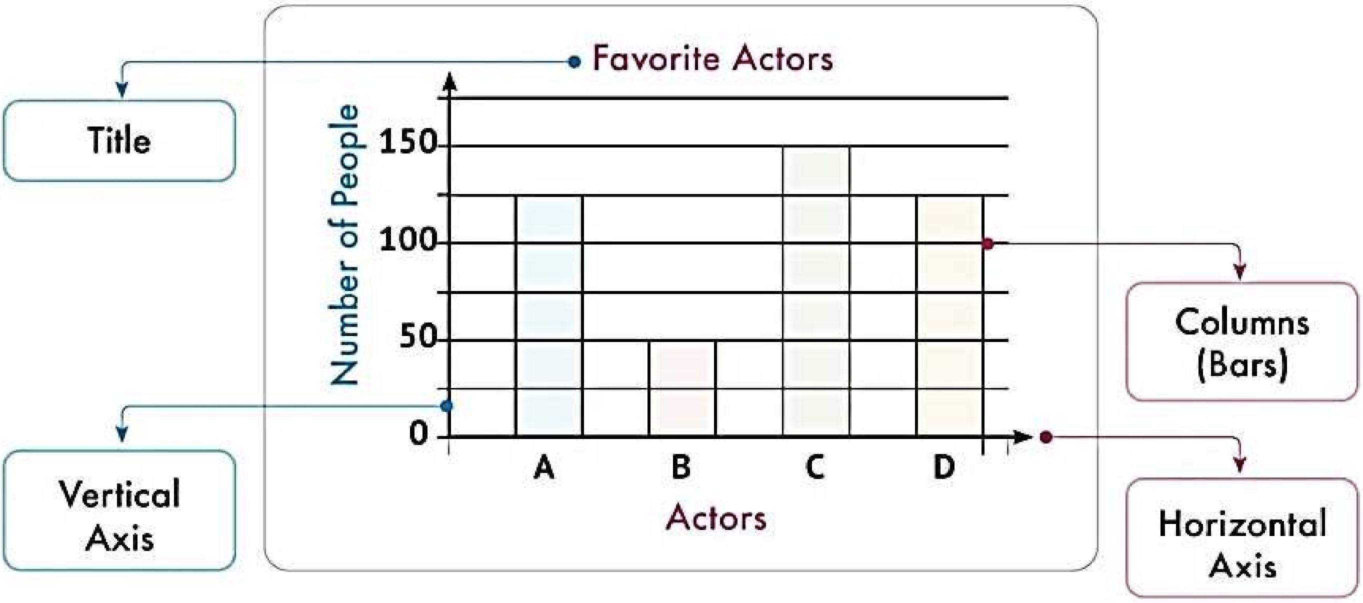
Bar Graph

- It is used to represent categorical and numerical data.

Characteristics that all bar graphs share:

- Titles.
- Two axes:
  - Horizontal axis to represent data, which can be anything.
  - Vertical axis has a scale.
- Labels for each axis.
- Shows categorical data.
- Bars represent data.
- Each bar represents one category or one value.
- Equal gaps between bars.
- Bars can be rearranged.

Ex. The opposite bar graph shows the preferred actors of a number of people.



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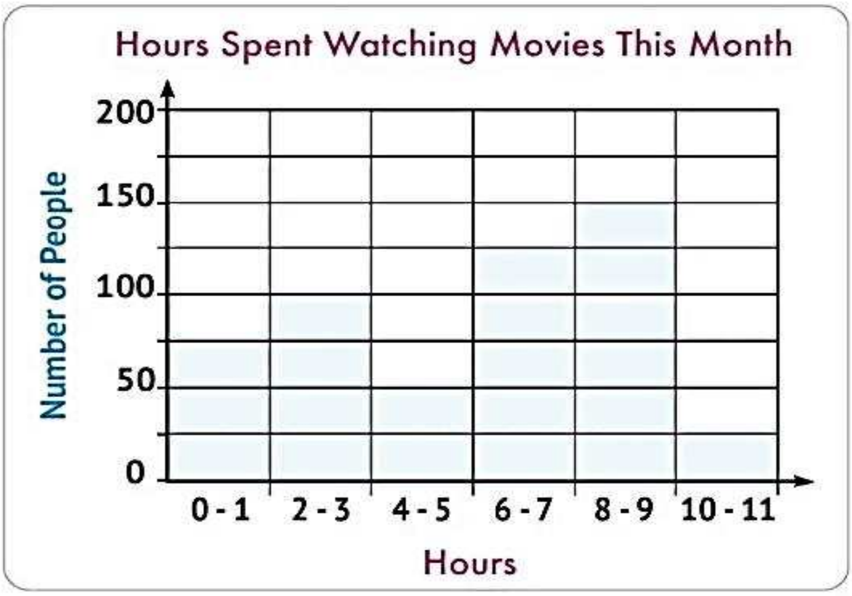
Histograms

- It is used to represent numerical data only.

Characteristics that all histograms share:

- Titles.
- Two axes:
  - – Horizontal axis to represent data, which can be anything.
  - – Vertical axis has a scale.
- Labels for each axis.
- Shows numerical data.
- Bars represent data.
- No gaps between bars
  [unless data are not given in a specific interval].
- Bars should not overlap.
- Bars can not be rearranged.

Ex. **The following histogram represents the number of hours spent watching movies by a number of people.**



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Comparing Bar Graphs and Histograms

Bar Graph	Histogram
• It can show categorical and numerical data.	• It displays numerical data.
• Each bar represents one number, one number interval, or one category.	• Each bar represents an interval.
• It requires equal spaces between each bar or a different color for each bar.	• There is no space between the bars unless there is no data for a particular interval.

Both of Bar Graphs and Histograms →

- Have horizontal and vertical axes.
- Can display numerical data.
- Have titles and labels for both axes.
- Need a scale for the vertical axis.
- Use bars to represent the data.

1 What is the best graph for the following situations?

(Bar graph) or (Histogram)

ⓐ How many students got grades in the final exam from 80 to 89? (............Histogram............)

ⓑ What are all the students' heights rounded to the nearest centimeter in your class? (............Bargraph............)

ⓒ What are the favorite colors of the students in your class? (............Bargraph............)

ⓓ What are the math test scores for the month of November? (............Bargraph............)

ⓔ How many films are 60 to 80 minutes long? (............Histogram............)

ⓕ What is the number of amusement park visitors during the week days? (............Bargraph............)

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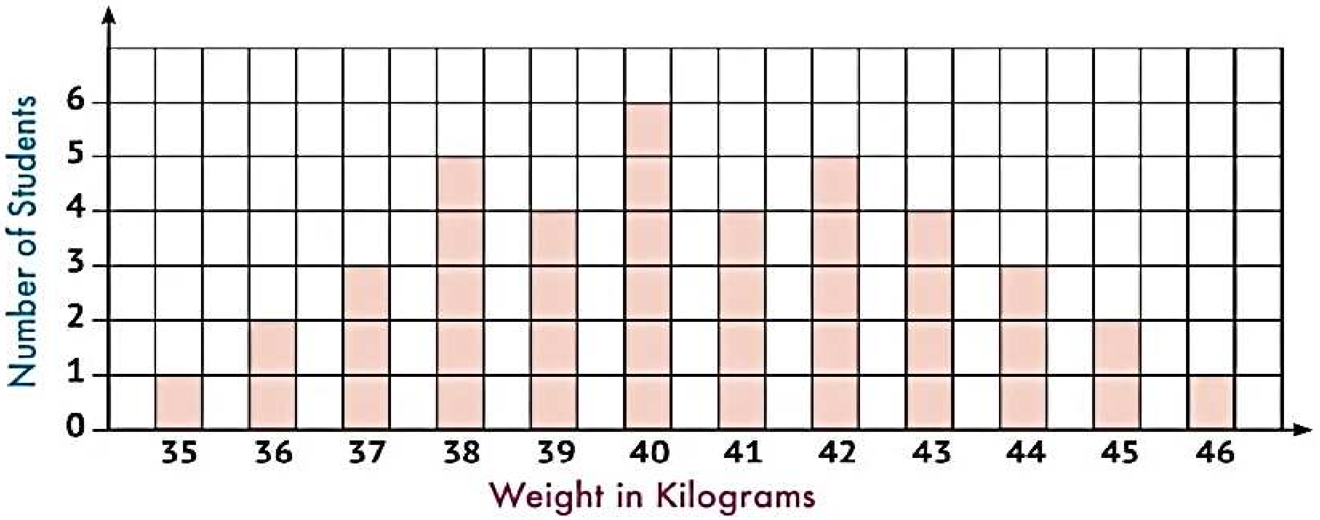
Creating Histograms to Represent Data

Ex. The following frequency table shows the weights in the students of a class consisting of 40 students.

- It can be represented graphically by bar graph, as follows:

Weight in Kilograms	35	36	37	38	39	40	41	42	43	44	45	46
Frequency (Number of Students)	1	2	3	5	4	6	4	5	4	3	2	1



To Create a Histogram to Display the Previous Data

- This data must be placed at suitable intervals, as follows:

1. Choose an interval size that makes sense for this data set.

   So that each interval consists of 3 items, and therefore the number of intervals is (4).

2. Compile the previous frequency table, as follows:

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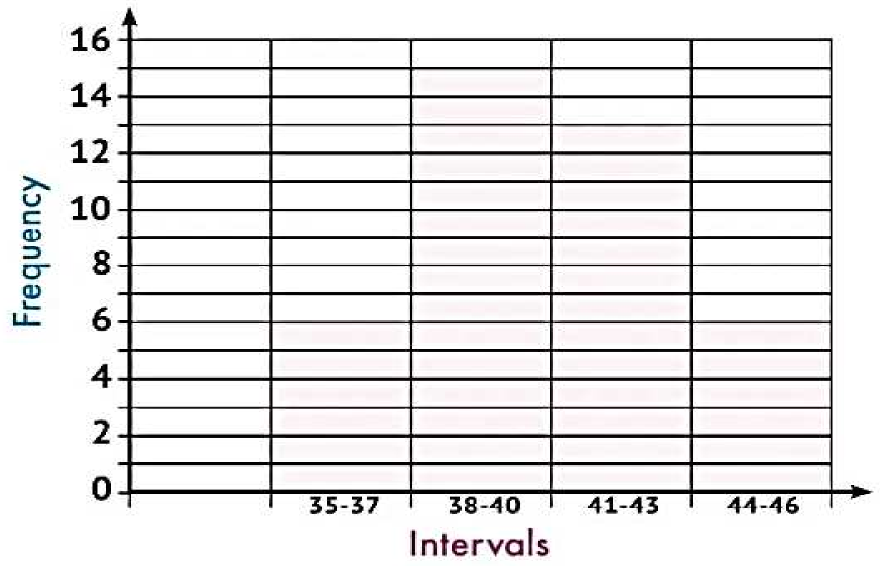
Weight in Kg	Frequency
35	1
36	2
37	3
38	5
39	4
40	6
41	4
42	5
43	4
44	3
45	2
46	1

Intervals	Frequency
35 – 37	6
38 – 40	15
41 – 43	13
44 – 46	6

To create a histogram using the previous frequency distribution table:

- On the horizontal axis, place the intervals.
- On the vertical axis, place frequencies. Label this axis "Frequency".
- Draw a bar for each interval without leaving spaces between these bars as shown in the following figure.



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Ex.

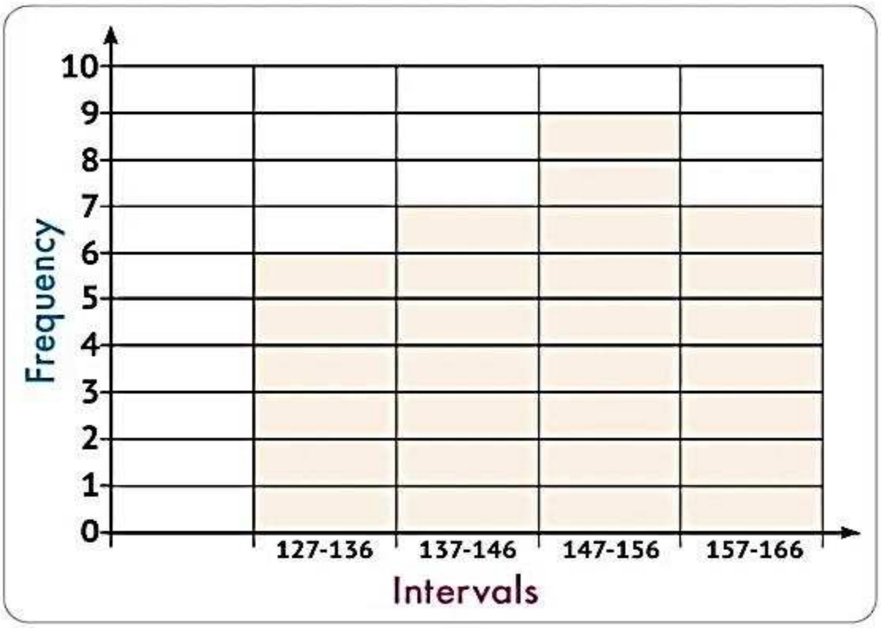
The following frequency table shows the data collected by the students. Draw a histogram showing this data. Make sure to choose an appropriate interval for this data set:

Arm Span (cm)	Frequency
127	2
132	3
135	1
138	1
141	1
142	2
143	1
144	2

Arm Span (cm)	Frequency
147	2
149	2
152	3
153	2
157	2
158	3
160	1
166	1

- From the previous table, we make a table of intervals where the length of the interval is **10** items.

Intervals	Frequency
127 – 136	6
137 – 146	7
147 – 156	9
157 – 166	7



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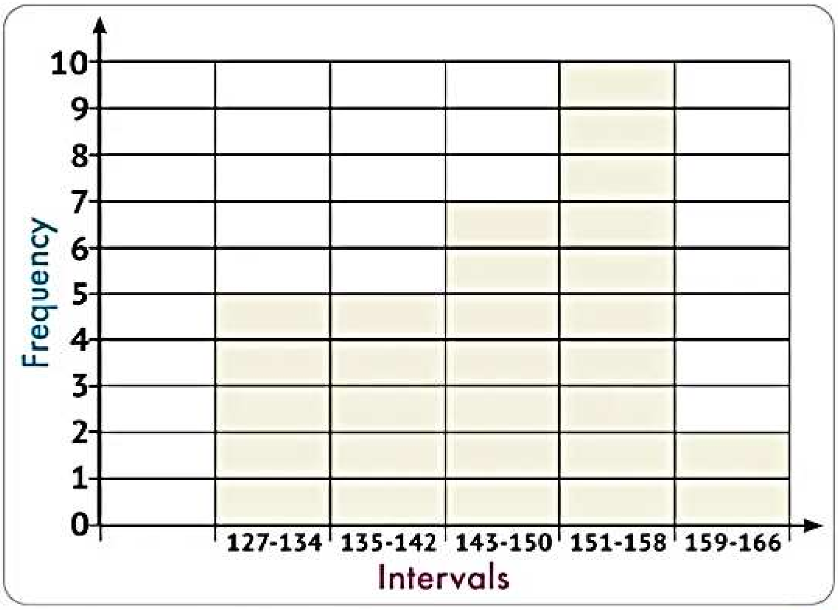
- Intervals of length
  8 items can be created.

Intervals	Frequency
127 – 134	5
135 – 142	5
143 – 150	7
151 – 158	10
159 – 166	2

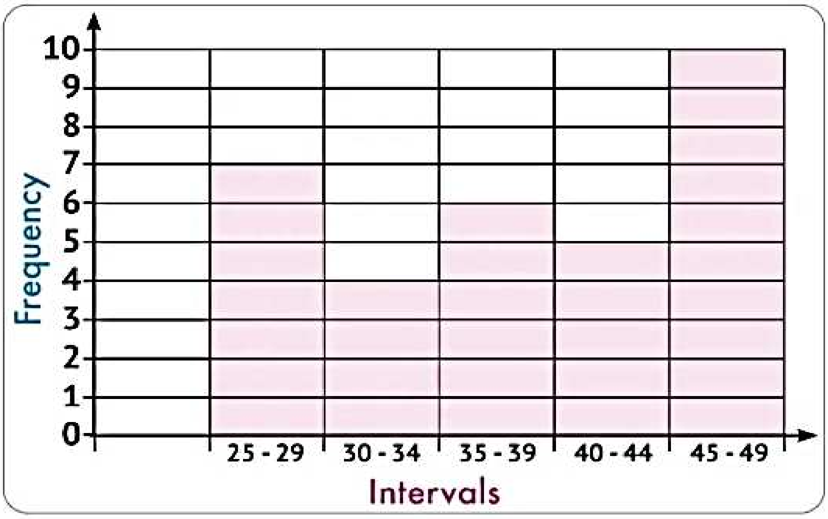


2 The following frequency table shows the grades obtained by 32 students in mathematics in the first semester:

Grades	Frequency
25	3
26	1
28	3
30	1
32	2
34	1
35	1
36	2
38	1

Grades	Frequency
39	2
40	1
42	3
44	1
45	3
46	1
47	1
48	3
49	2

Intervals	Frequency
25 - 29	7
30 - 34	4
35 - 39	6
40 - 44	5
45 - 49	10



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Exercises on lessons 2 and 3

1 What is the best graph in the following situations?

(Dot Plot - Bar Graph - Histogram)

a) How many students prefer the red color? (..)

b) How many students got grades in the exam from 15 to 20? (..)

c) What is the number of pupils in each class of the school? (..)

d) How many students in your class have a family of 5? (..)

e) How many Egyptian cities have a population of 2,000,000 to 3,000,000? (..)

f) How many trees in the garden have a height of 3 to 4 meters? (..)

g) How many passengers are in the first-class train? (..)

h) How many cities had a temperature of 40 degrees last summer? (..)

i) How many students get 15 degrees in the monthly exam? (..)

j) How many students had 7-10 days of defective days during the past year? (..)

k) How many students in your class are between 150 and 160 cm in height? (..)

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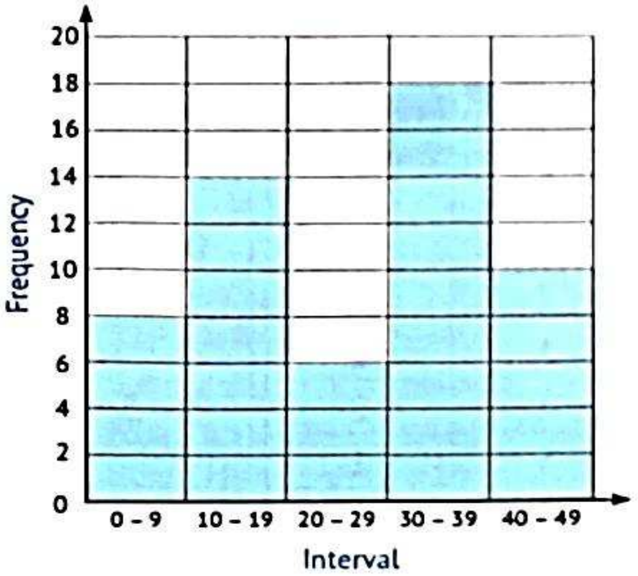
2 Complete the following interval table, using the following histogram:

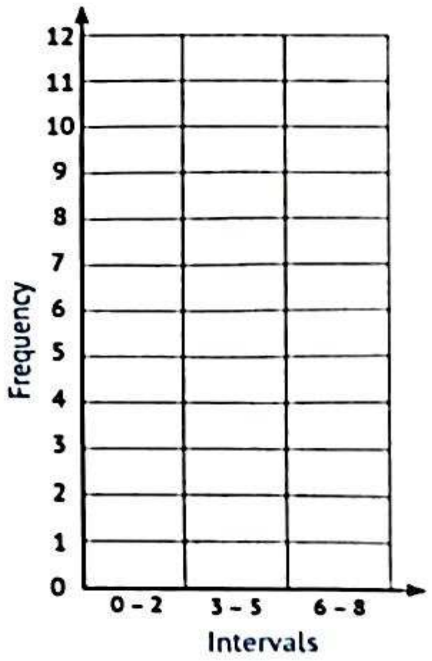
Intervals	Frequency
0 – 9	....
10 – 19	....
20 – 29	....
30 – 39	....
40 – 49	....



3 The following frequency table shows the number of days of absence for 26 students in the class during the first semester. Compose a table of periods and then complete the iterative drawing:

Number of Days	Frequency
0	3
1	2
2	5
3	4
4	6
5	1
6	0
7	3
8	2

Intervals	Frequency
0 – 2	....
3 – 5	....
6 – 8	....



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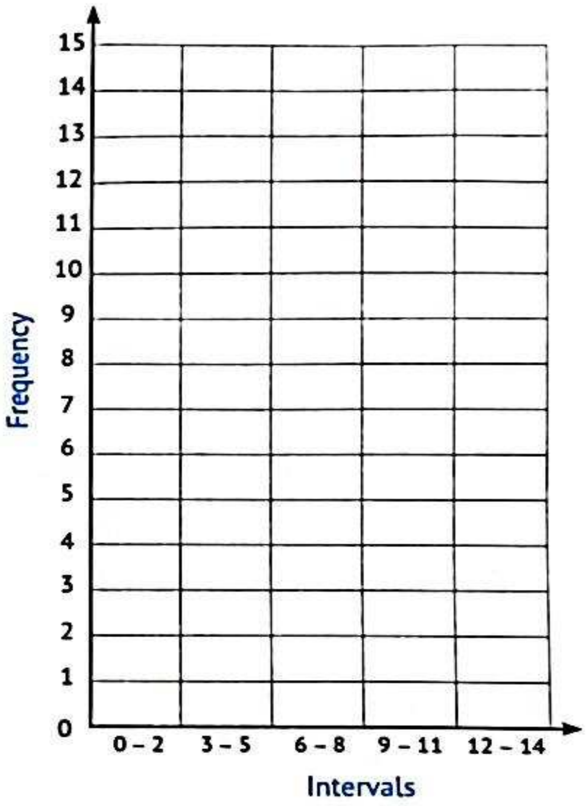
4 The following frequency table shows the number of stories that students read during the school year. Complete the interval table, then complete the frequency histogram drawing:

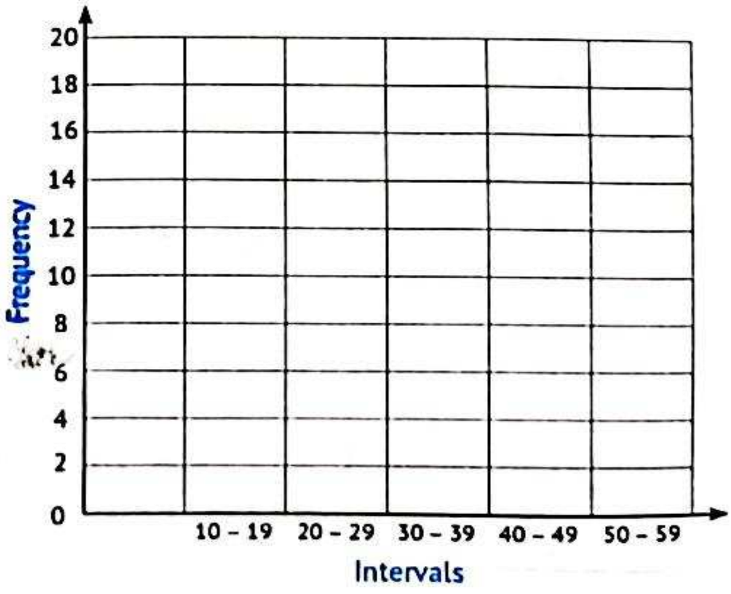
Number of Stories	Frequency
0	2
1	3
2	4
3	1
4	2
5	1
6	1
7	4
8	3
9	1
10	2
11	1
12	2
13	1
14	1

Intervals	Frequency
0 – 2	....
3 – 5	....
6 – 8	....
9 – 11	....
12 – 14	....



5 Draw the histogram of the following distribution, which represents the scores of 50 students:

Interval Grades	Frequency Number of students
10 – 19	8
20 – 29	14
30 – 39	6
40 – 49	18
50 – 59	4



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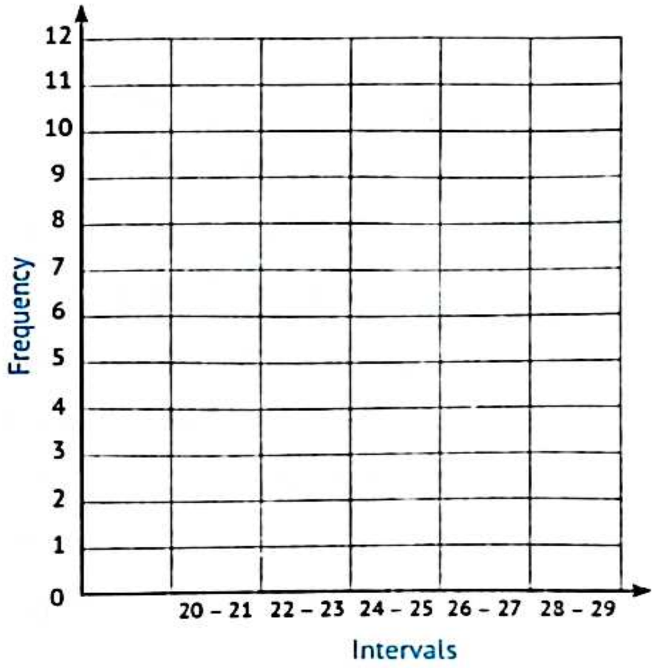
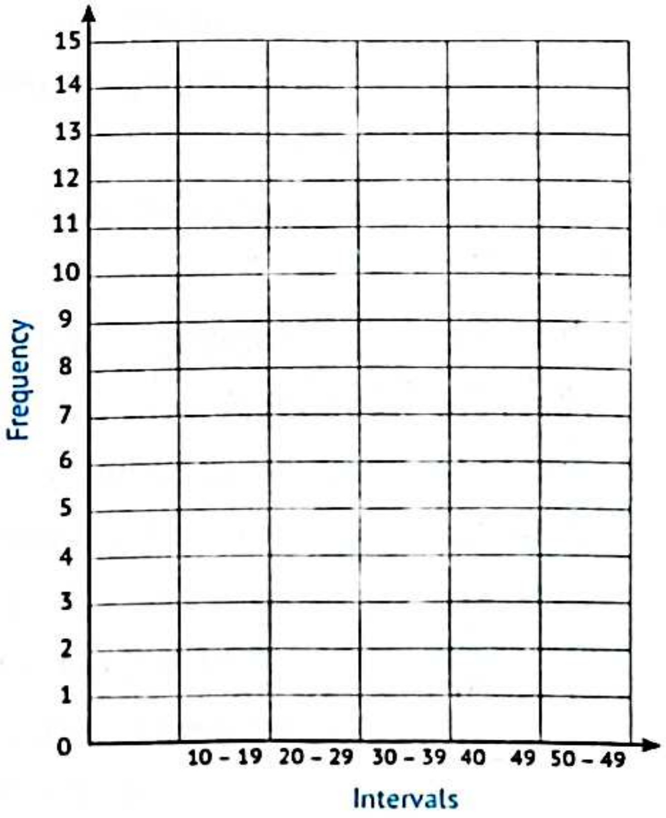
6 Draw the histogram of the following frequency distribution that represents the recorded temperatures in 40 cities in one day:

Interval Temperatures	Frequency Number of Cities
20 – 21	8
22 – 23	12
24 – 25	9
26 – 27	7
28 – 29	4



7 The following table shows the number of cars violating traffic lights that were detected by surveillance cameras at different time periods. Draw the histogram for this frequency distribution:

Interval In Minutes	Frequency Number of Cars
10 – 19	6
20 – 29	7
30 – 39	15
40 – 49	8
50 – 59	12



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8 Choose the correct answer:

a) The horizontal axis includes numerical periods in ....

(dot plot or bar graph or double bar graph or histogram)

b) .... don't have a vertical axis.

(Dot plots or Bar graphs or Double bar graphs or Histograms)

c) .... may use separate columns to represent the data.

(Dot plots or Bar graphs or Double bar graphs or Histograms)

d) .... have horizontal axis.

(Bar graphs or Double bar graphs or Histograms or All of the previous)

e) In the dot plots, ... (columns are used to represent data

or there is no need for a horizontal axis

or each information is represented by a point

or data is displayed grouped in intervals)

f) In the bar graph, ...

(each bar represents a number or one categorical data

or it does not need a vertical axis or the bars must touched

or each piece of information is represented by a dot)

g) In the histogram, ... (it does not need a vertical axis

or the bars must touch or data is shown above the number line

or all bars are evenly spaced)

h) In each of the bar graphs and histograms ....

(bars are used to represent data or each bar represents an interval

or each bar represents one number or the data is shown above the number line)

i) In .... there is a graduated scale for the vertical axis.

(the dot plot only or the bar graph only

or histogram only or both of bar graph and histogram)

j) .... may be used to display numerical data.

(Dot plots or Bar graphs or Histograms or All of the previous)

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Quiz

___ / 10

1 Match each of the following situations with the best graph to represent it:

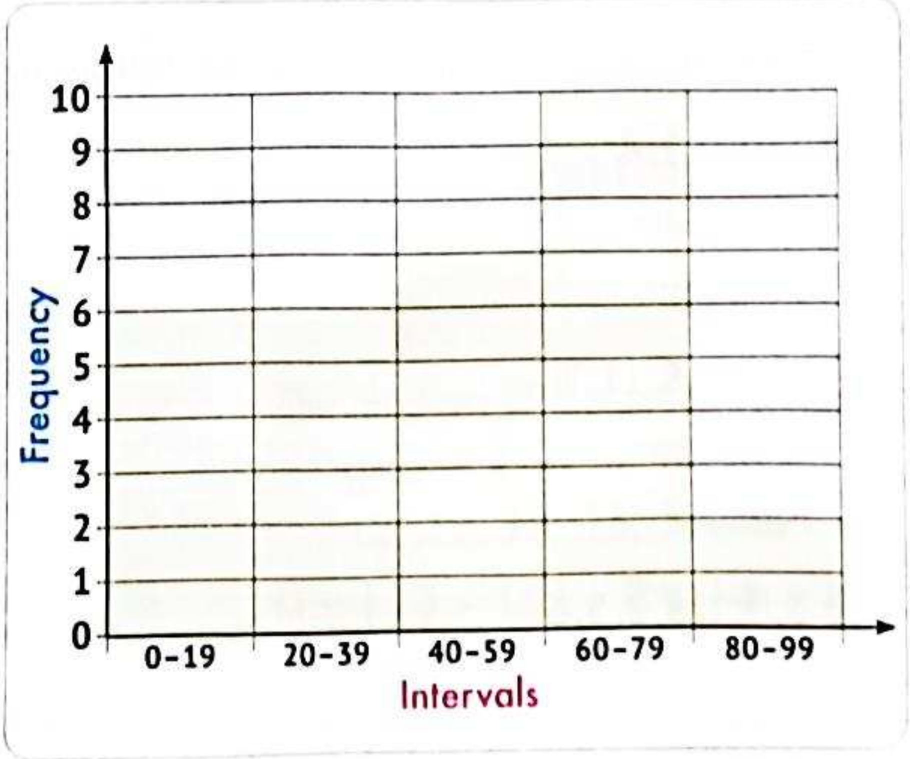
ⓐ How many students do their families consist of 4 people? • • Histogram **1**

ⓑ How many sixth-grade students are there in your school? • • Dot Plots **2**

ⓒ How many students in your class are 130 – 150 cm tall? • • Bar Graph **3**

2 Use the following histogram to complete the following interval table:

Intervals	Frequency
0 – 19	....
20 – 39	....
40 – 59	....
60 – 79	....
80 – 99	....



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Unit 6

Lesson 4

Exploring Box Plot

Explaining

The Median

- It's the value of the element appearing at the middle of the data set when the data are arranged in order (an ascending order or a descending order).
- If the data set has an even number of values, then the median is half the sum of the two values at the middle.

For example: Write the median for each of the following data sets:

ⓐ 3, 5, 8, 3, 7

The order: 3, 3, 5, 7, 8

Median: 5

ⓑ 7, 9, 3, 4, 4, 6

The order: 3, 4, 4, 6, 7, 9

Median: (4 + 6) ÷ 2 = 5

Box Plots

- It's a data display that represents numerical data based on a 5-point summary of the data set.

1. The minimum value
2. The first quartile (Q1) or (Lower Quartile)
3. The second quartile (Q2) or (Median)
4. The third quartile (Q3) or (Upper Quartile)
5. The maximum value

Ex. Draw a box plot to represent the following values:

15, 17, 13, 11, 12, 9, 0, 12, 18, 4, 7, 1, 0

- To draw a box plot for the set of displayed values, the 5-point summary must be specified after arranging this data in an ascending order:

Minimum Value → 0, 0, 1, 4, 7, 9, 11 (Median), 12, 12, 13, 15, 17, 18 ← Maximum Value

Lower Quartile

The median of the set of values is less than the median.

"0, 0, 1, 4, 7, 9"

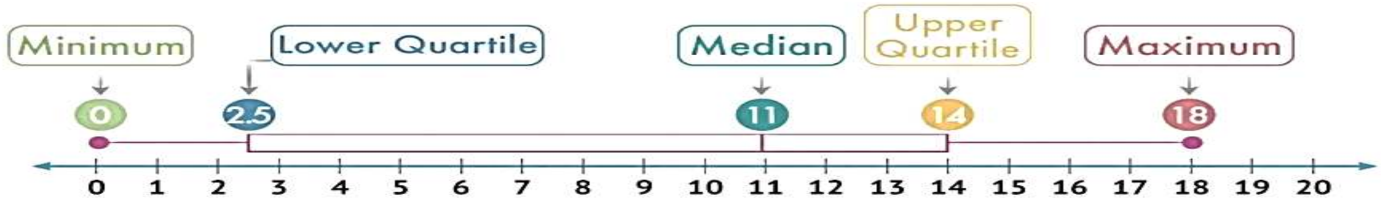
Q1: (1 + 4) ÷ 2 = 2.5

Upper Quartile

The median of the set of values is greater than the median.

"12, 12, 13, 15, 17, 18"

Q3: (13 + 15) ÷ 2 = 14



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Exercises on lesson 4

1 Complete the following:

ⓐ The median of a set of values is the element that appears in .... of that set.

ⓑ The median of the set of values (5, 7, 8, 3, 6) is ....

ⓒ The median of the set of values (9, 3, 7, 5) is ....

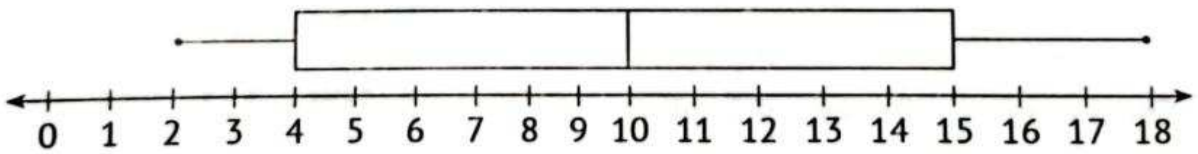
ⓓ The minimum value of (7, 8, 5, 7, 3) is ....

ⓔ The maximum value of (6, 3, 2, 4, 1) is ....

ⓕ In the values (7, 6, 2, 9, 6, 0, 6), the lower quartile is .... and the upper quartile is ....

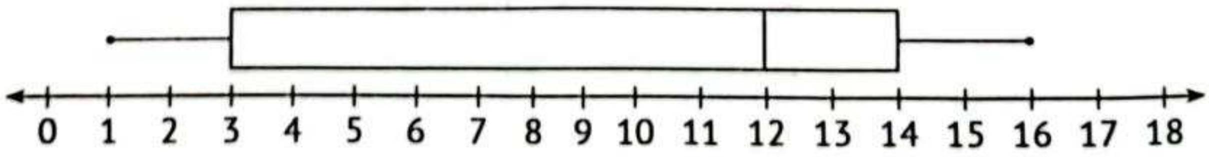
2 In each of the following, use the following box plots, select a summary of the five values:

ⓐ



[1] The minimum value: ....
[2] Lower quartile: ....
[3] The median: ....
[4] Upper quartile: ....
[5] The maximum value: ....

ⓑ



[1] The minimum value: ....
[2] Lower quartile : ....
[3] The median: ....
[4] Upper quartile: ....
[5] The maximum value: ....

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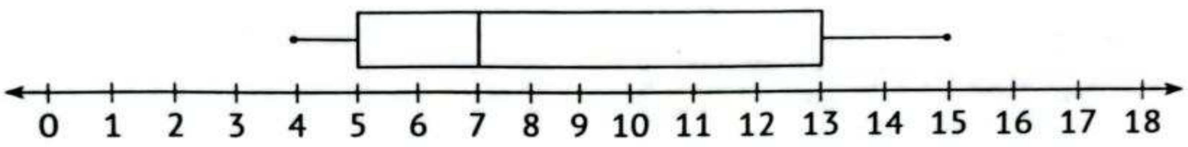
c

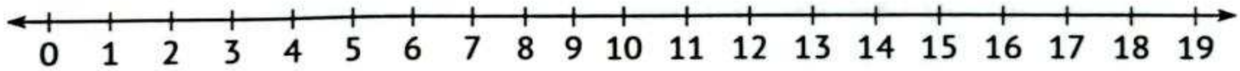


1. The minimum value: ....
2. Lower quartile: ....
3. The median: ....
4. Upper quartile: ....
5. The maximum value: ....

3 Draw a box plot for each of the following groups of values:

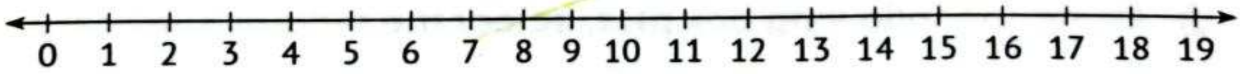
a 9, 8, 3, 1, 10

1. The minimum value: ....
2. Lower quartile: ....
3. The median: ....
4. Upper quartile: ....
5. The maximum value: ....



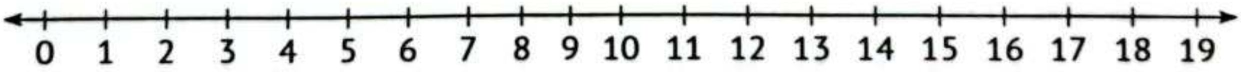
b 15, 8, 9, 2, 7, 5, 4

1. The minimum value: ....
2. Lower quartile: ....
3. The median: ....
4. Upper quartile: ....
5. The maximum value: ....



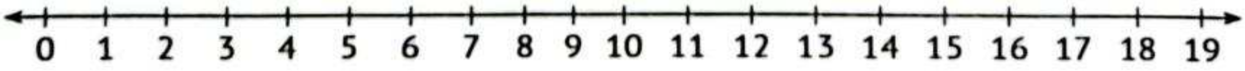
c 3 , 8 , 1 , 9 , 5 , 6 , 5 , 1

1. The minimum value: ....
2. Lower quartile: ....
3. The median: ....
4. Upper quartile: ....
5. The maximum value: ....



d 5, 6, 3, 7, 1, 0, 8, 8, 2, 1

1. The minimum value: ....
2. Lower quartile: ....
3. The median: ....
4. Upper quartile: ....
5. The maximum value: ....



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Quiz

____ / 10

1 For the set of values: 3 , 11 , 7 , 2 , 3 , 8 , 7, complete:

ⓐ Minimum Value: ....

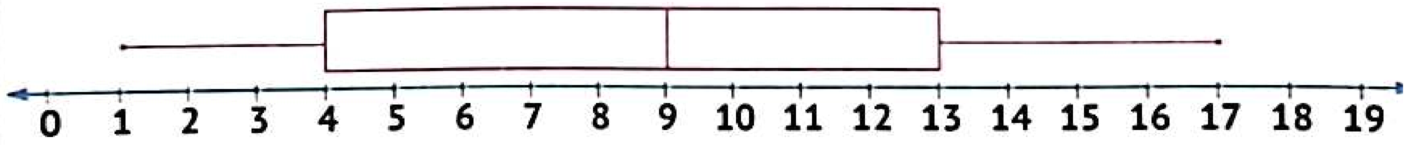
ⓑ Lower Quartile: ....

ⓒ Median: ....

ⓓ Upper Quartile: ....

ⓔ Maximum Value: ....

2 Using the following box plot, identify the 5-point summary of the data set:



ⓐ Minimum Value: ....

ⓑ Lower Quartile: ....

ⓒ Median: ....

ⓓ Upper Quartile: ....

ⓔ Maximum Value: ....

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Unit 6

Lesson 5

Applications on Data Representations

Explaining

Dot Plot - Histogram - Box Plot

- Each of them is suitable for representing numerical data. To choose the most appropriate graph for a set of data, the purpose of using the graph must be determined.

Dot plot	would be more appropriate if the purpose is	representing individual data and the number of presented values.
Histogram		representing the peaks, gaps, and data collection.
Box plot		representing a large number of data using the 5-points summary.

Examples of statistical questions that can be answered using the above representations:

The question is about the	Dot Plot	Histogram	Box Plot
ⓐ Total number of values represented	✓	✓	
ⓑ Number of times each value is repeated	✓		
ⓒ Most frequent value	✓		
ⓓ Least frequent value	✓		
ⓔ Number of repetitions of values in a specified period	✓	✓	
ⓕ Number of repeated values for a set of periods	✓	✓	
ⓖ Gaps	✓	✓	
ⓗ Maximum value	✓		✓
ⓘ Minimum value	✓		✓
ⓙ 5-point summary	✓		✓
ⓚ Median	✓		✓

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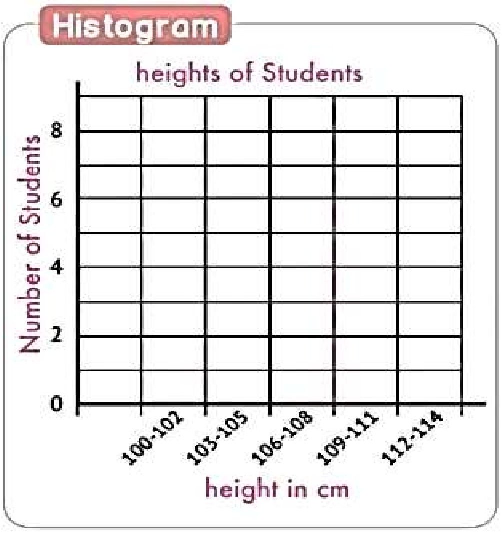
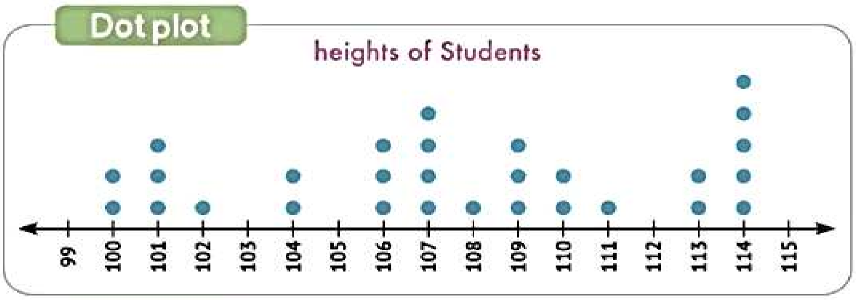
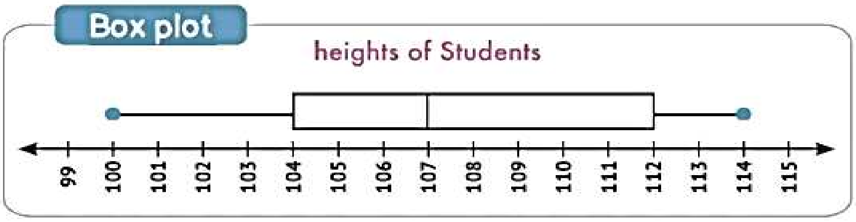
Ex. The following graphs represent the heights of a number of students, rounded to the nearest centimeter.







Dot plot

- It shows the number of students and the height of each student accurately.
- The tallest student is 114 cm tall and the shortest is 100 cm.
- The most frequent height is 114 cm.

Histogram

- It shows that the tallest students range in height from 112 cm to 114 cm.
- It shows that the least frequent heights are from 103 cm to 105 cm.
- It shows that the most common heights are from 106 cm to 108 cm.

Box plot

- It shows that the shortest student is 100 cm tall and that the tallest student is 114 cm tall.
- The median is 107, the first quartile is 104, and the second quartile is 112.

Important Note: • There are questions that can only be answered through one of the previous graphs (dot plots), and other questions that can be answered through the other two graphs, and some questions can be answered through the three graphs.

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Exercises on lesson 5

1. Label each question with the type/ types of graph that would display the answer.

dot plot | box plot | histogram

a. The shape shows individual data ________

b. The shape shows the maximum value ________

c. The shape shows the median ________

d. The shape shows the set of data in form of intervals ________

e. The shape shows lower quartile ________

f. The shape shows gaps and cluster ________

g. The shape shows the most frequent number ________

h. The shape shows spread of the data in each quarter ________

i. The shape shows the number of all individual data ________

j. The shape does not show the five-number summary ________

k. The shape does not show the individual data ________

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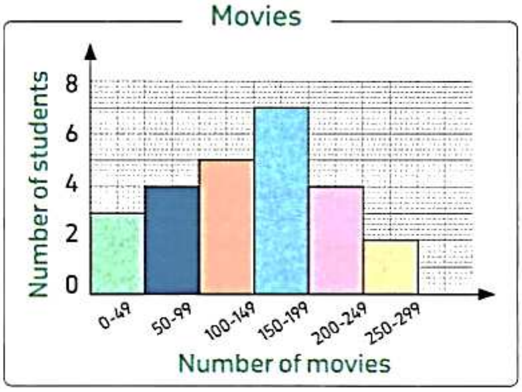
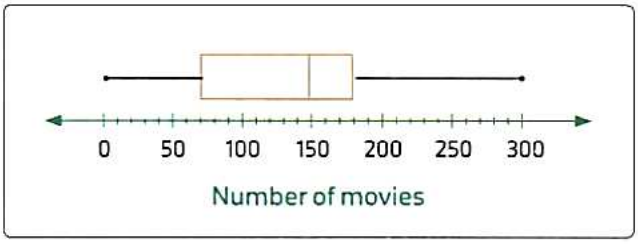
2. Hany collected data about how many movies on the laptops with the students in his class and then created a histogram and a box plot to display the same data :





Answer the following questions :

a. Which display can be used to find how many students have 150 movies or more ?

b. Which display can be used to find the minimum number of movies ?

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c. Which display can be used to find the lower quartile ?

d. Which display can be used to find that there were 25 students at the class ?

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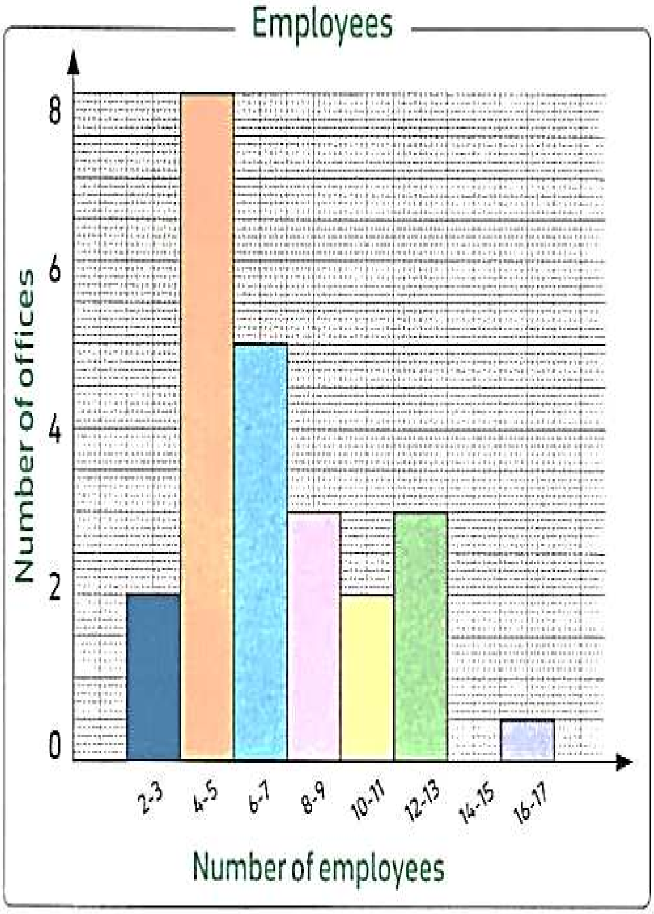
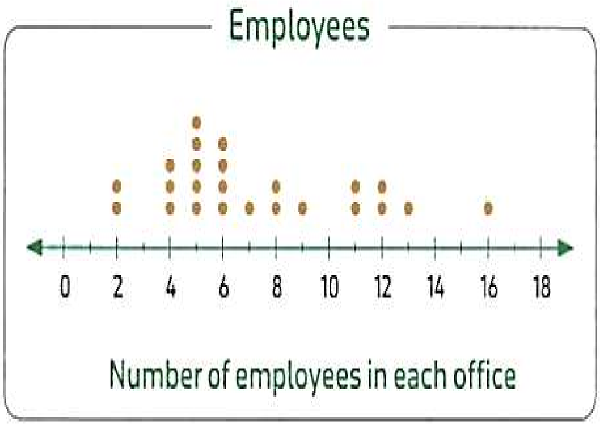
3. If you collected data about the number of employees in each office in a company and created both a histogram and a dot plot to display the same data.





a. Which display can be used to find the maximum number of employees in an office ?

b. Which display can be used to find the number of offices that contain 6 employees or more and less than 10 employees ?

c. Which display can be used to find the upper quartile of the number of employees ?

d. Which display makes it clear that there are no offices with 3 employees ?

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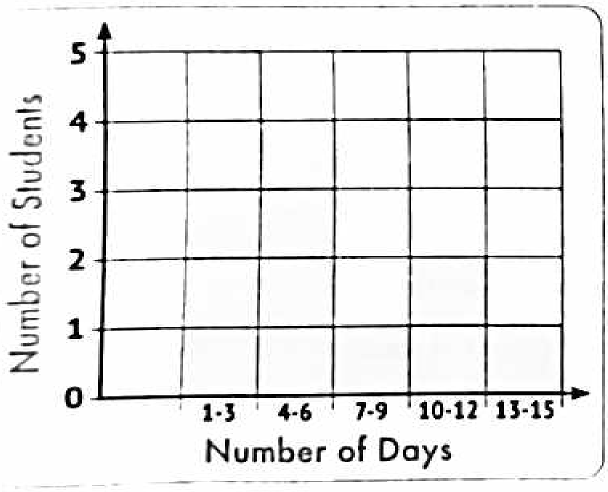
Quiz

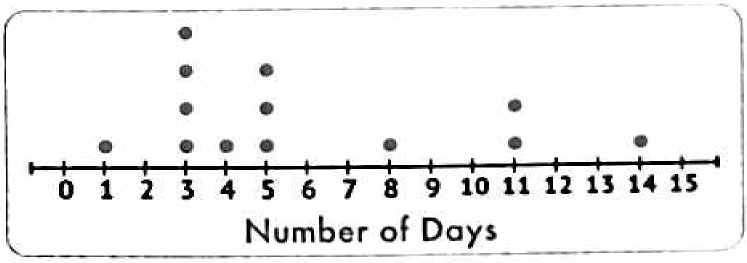
/ 10

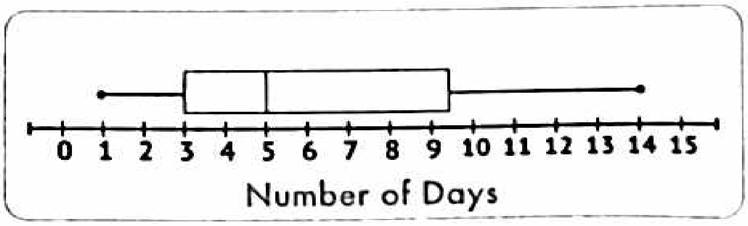
1 Match each statistical question with the best graph that can be used to answer it:

ⓐ What is the most frequent value? •		• Histogram	1
ⓑ What is the most frequent interval? •		• Box Plot	2
ⓒ What is the upper quartile? •		• Dot Plot	3

2 The following graphs show the number of days absent for a group of students:







Write two questions would be better to answer using:

ⓐ Dot plot:

1 .... 2 ....

ⓑ Histogram:

1 .... 2 ....

ⓒ Box plot:

1 .... 2 ....

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Unit 7
Lessons 1 and 2

Exploring the Balance of Data Sets
Interpreting Arithmetic Mean

Explaining

- **Measures of central tendency (center)** are a group of measures that describe a gathering point around central values. General measures of central tendency are the mean, median, and mode.

- **The mean** is a numerical value that represents the average of a set of values.

Ways to Find the Mean of a Set of Numerical Values

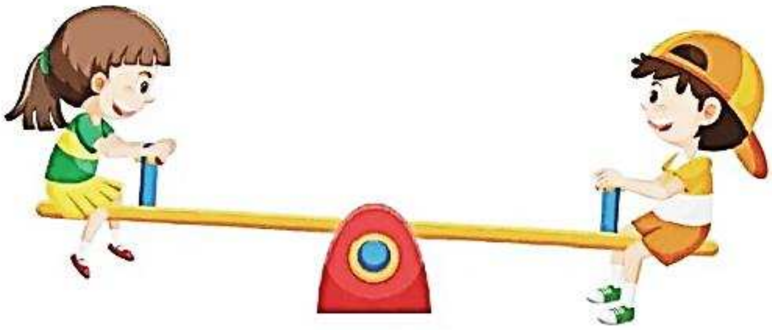
First: Finding the Mean by Finding the Balance Point

(The value of the center of a set of data)

- When representing data graphically using a dot plots graph, the mean of a set of data is the value of the balance point of that set of data.

Balance point (the center of a set of data)

- It's a point on a number line or in a data set in numerical order such that the numbers are balanced on both sides.



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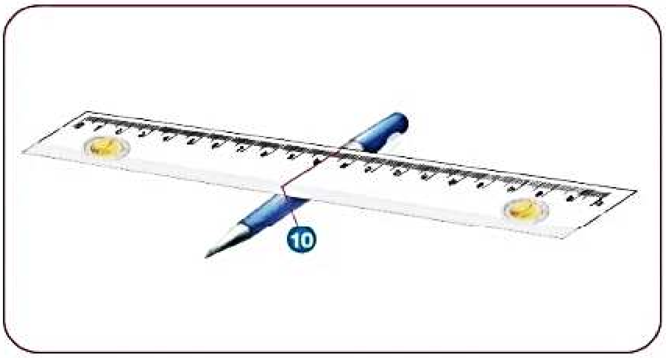
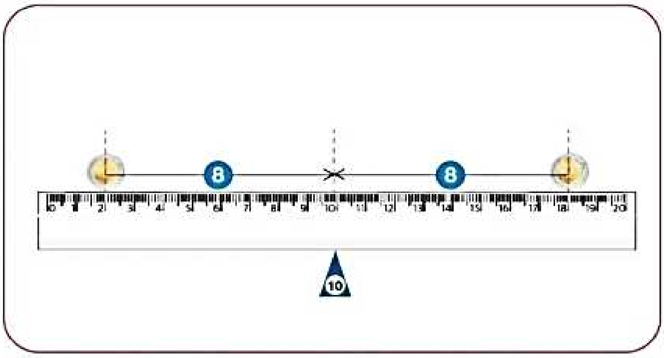
Balance Game

- Bring a ruler (20 cm), some coins, and a pen.



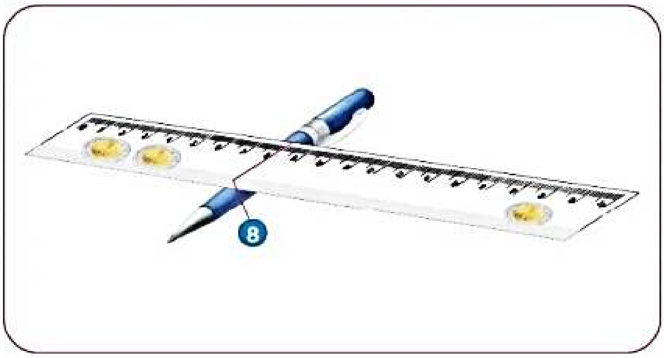
- Put a coin at number (2) and another coin at number (18) on the ruler and move it over the pen until it becomes balanced, as shown in the pictures.
- **Notice** the position of the pen at which the ruler is balanced.



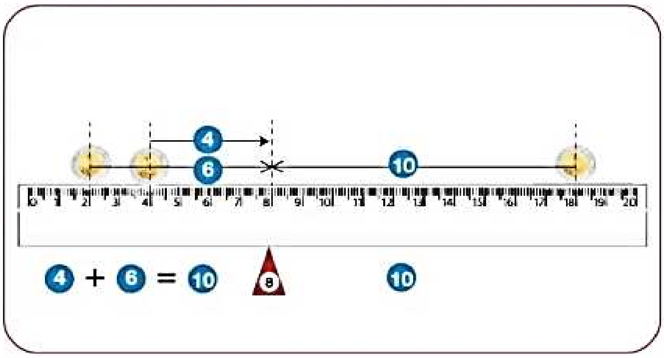
You find it on number 10, which is the balance point.

So, the mean of the two numbers 2 and 18 is 10.

- Add another coin at number (4) on the ruler and move it over the pen until it becomes balanced, as shown in the pictures.



- **Notice** the position of the pen at which the ruler is balanced.



You find it on number (8), which is the balance point.

The mean of the numbers (2, 4, 18) is 8

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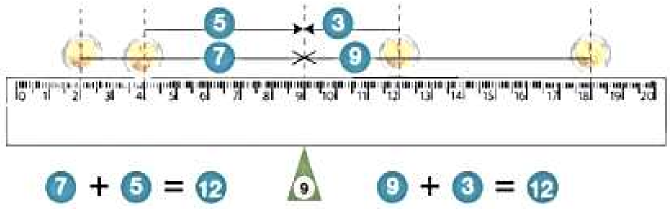
- Add another coin at number (12) on the ruler and move it over the pen until it becomes balanced, as shown in the pictures.

- Notice the position of the pen at which the ruler is balanced.

You find it on number (8), which is the balance point.

You also find it on number (10), which is the balance point).



The mean of the numbers 2, 4, 12, 18 is 9.

Repeat the game, add more coins, and notice the change in the balance points with the change in the positions of the coins.

Important Note:

- If we add the distances between the numbers and the mean (the balance point) on each side, each time we find that the sum of these distances is always equal on both sides (balanced).

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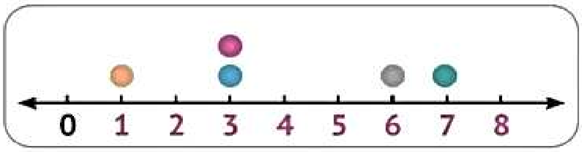
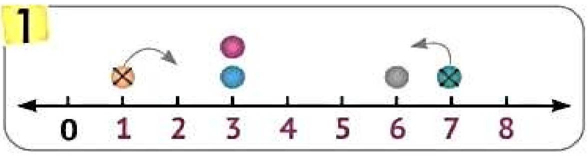
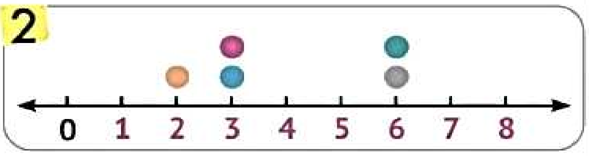
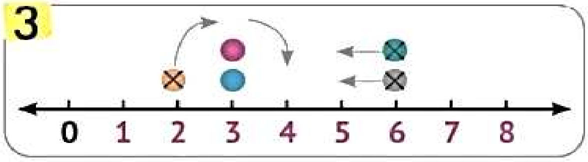
Ex.

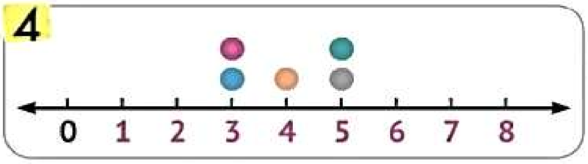
Determine the mean (balance point) for the data represented using the following dot plot:

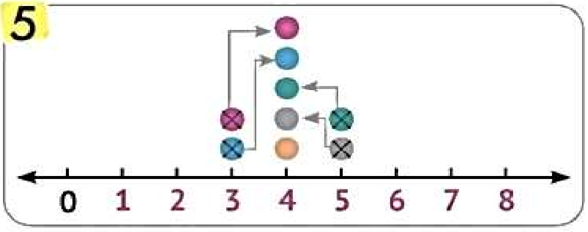








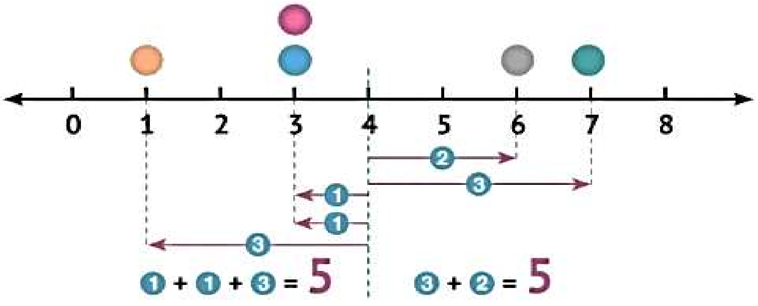




Notice that:

- Moving one point in two steps is equivalent to moving two points in one step.
- The number at which all points congregate is the center of this set of data. The mean is 4.

When adding the distances between the points and the mean from both sides, they must be equal (balanced).



From the foregoing, we find that the data center represented by the previous point chart is number 4.

That is, the mean of the numbers 7, 6, 3, 3, 1 is 4.

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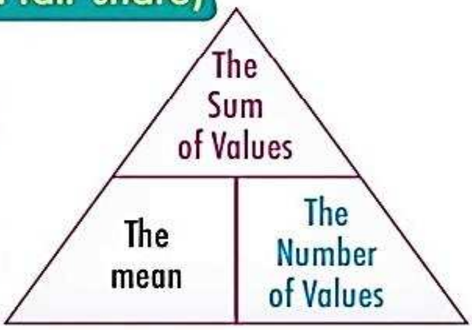
Second: The Mean Algorithm (the mean as a fair share)

$$\text{The mean} = \frac{\text{The Sum of Values}}{\text{The Number of Values}}$$

The Number of Values X The mean
= The Sum of Values



Ex. A group of students each has a number of pens, as shown in the table:

Student	Mahmoud	Saleh	Hady	Mark	Nader
Number of Pens	6	7	2	3	7

- These students collected their pens together and redistributed them equally among themselves, so each of them had a share of:

$$\frac{6+7+2+3+7}{5} = \frac{25}{5} = 5 \text{ Pens}$$

Important Note:

- The redistribution has been made so that each of them has the same share, and this is the mean.

Ex.

If the mean of the values: 6, 7, x, 3 is 5, find the value of x.

Solution The mean x The number of values = The sum of the values

$6 + 7 + x + 3 = 4 \times 5$

$x + 16 = 20 \longrightarrow$ $\boxed{x = 4}$

Another Solution

Value of x = (The number of values X The mean) – The sum of given values

= (4 X 5) – 16

= 20 – 16 = 4

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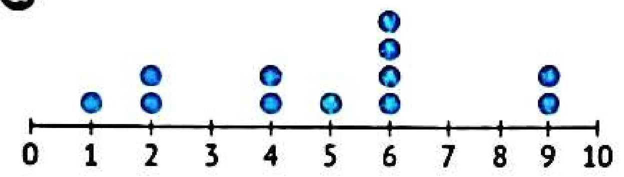
Exercises on lessons 1 and 2

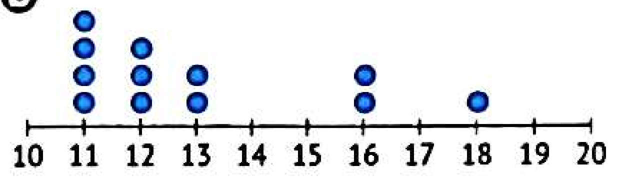
1 Determine the mean (the center of the data set) for each of the following graphs:

a



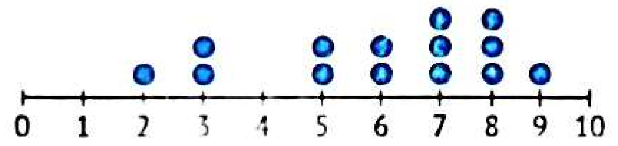
Mean = ...

b



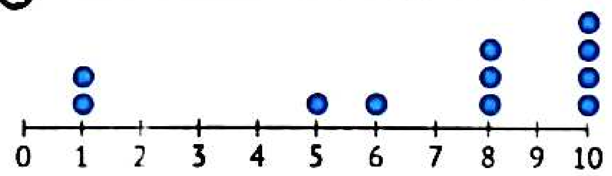
Mean = ...

c



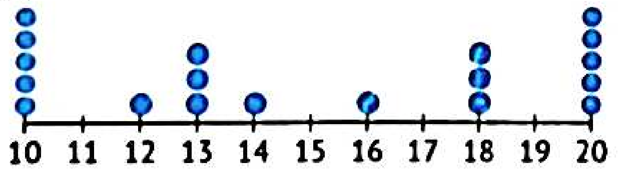
Mean = ...

d



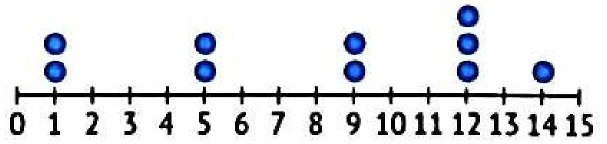
Mean = ...

e



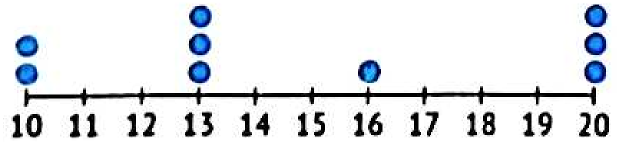
Mean = ...

f



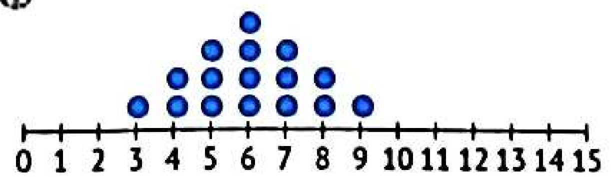
Mean = ...

g



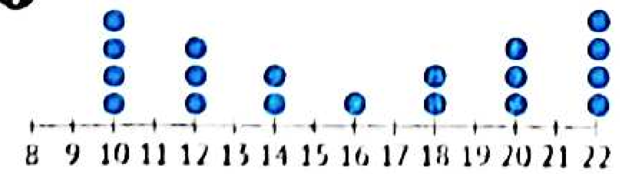
Mean = ...

h



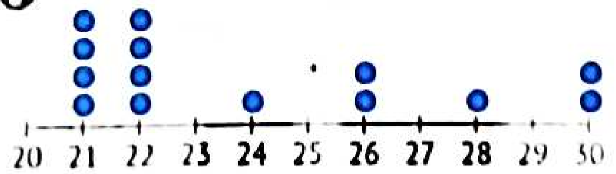
Mean = ...

i



Mean = ...

j



Mean = ...

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2 Find the mean for each of the following groups of values:

	Values	Mean
a	4, 6	....
b	3, 8	....
c	2, 4, 6	....
d	1, 3, 5	....
e	1, 2, 3, 4, 5	....
f	35, 50, 60, 55	....

3 If the heights of five pupils in the first preparatory grade in centimeters are: 124, 130, 122, 126, and 128.
Calculate the mean for these lengths.

....

....

4 If Sheriff's grades in 3 consecutive months in Mathematics are 89, 91, and 96, then calculate his mean of grades.

....

....

5 If the temperatures for a full week of December in one of the cities are: 25°, 27°, 31°, 23°, 22°, 18°, and 22°, then calculate the mean of these degrees.

....

....

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6 If the number of goals scored by Al-Ahly in 6 matches is:

4 , 2 , 3 , 1 , 0 , and 2 , then calculate the mean for the number of goals.

....

....

7 The following table represents the number of study hours for a student during 6 consecutive days:

Day	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday
Number of Hours	$3\frac{1}{2}$	3	$2\frac{1}{2}$	3	4	2

Calculate the mean of study hours per day.

....

8 Complete the following:

ⓐ The mean of the values (18,35,34,6) is ....

ⓑ The mean of the values (6,3,1,7,6,2,1,6) is ....

ⓒ If the mean of the values (3,4,6,x,7) is 6, then the value of x is ....

ⓓ If the mean of the values (2 ,7 ,2 ,x) is 3, then the value of x is ....

ⓔ If the sum of 7 values equals 56, then the mean of these values is ....

ⓕ If the sum of a set of values is 45, and the mean of these values is 5, then the number of these values is ....

ⓖ If the mean of a set of values is 8 and the number of these values is 6, then the sum of these values is ....

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9 Choose the correct answer:

a) The mean of the values (6, 7, 8, 4, 10) is .... (35 or 7 or 10 or 4)

b) The mean of the values (4, 9, 7, 1, 1, 2) is .... (4 or 2 or 3 or 24)

c) If the mean of a set of values is 3 and the number of these values is 8, then the sum of the values is equal to .... (11 or 24 or 5 or 8)

d) If the mean of a set of values is 9 and the sum of these values is 45, then the number of these values is .... (5 or 45 or 50 or 9)

e) If the mean of the scores of five students is 20, then the sum of their scores is .... a degree (4 or 15 or 25 or 100)

f) If the mean of Manal and Siham's ages is 7 years, and Manal's age is 8 years, then Siham's age is .... years. (6 or 7 or 8 or 15)

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Quiz

$\frac{\quad}{10}$

1 Choose the correct answer:

ⓐ The mean of the values: 45, 15, 40, 70, 80 is .... (40 or 45 or 50 or 60)

ⓑ If the mean of the values 12, 15, x, 8 is 10, then the value of x is .... (40 or 5 or 20 or 10)

ⓒ If the sum of 8 values equals 48, then the mean of these values is .... (40 or 56 or 24 or 6)

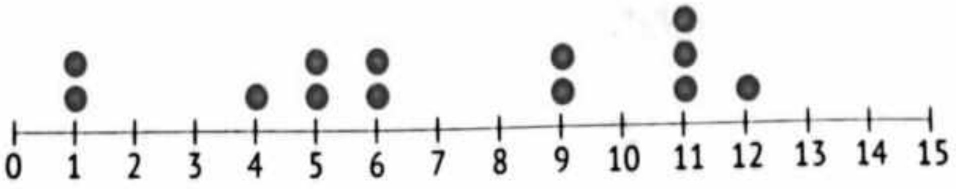
ⓓ If the sum of a set of values is 36, and the mean of these values is 6, then the number of these values is .... (6 or 42 or 30 or 216)

ⓔ If the mean of 9 values is 5, then the sum of these values is .... (45 or 14 or 4 or 95)

2 Determine the mean and the median for the following graph:

ⓐ Mean: ....

ⓑ Median: ....



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Unit 7 Lesson 3

Exploring Median, Mode, and Outliers

Explaining

The Mode

- The mode of a set of data is the most common (frequent) value in the set.

Some values might have

Only one mode

Ex.
- The values (5, 8, 5, 5, 6, 8, 5) have one mode, which is 5.

Because only 5 is the most frequent number.

More than one mode

Ex.
- The values (6, 5, 8, 6, 5, 7, 5, 6) have two modes, which are 5 and 6.

Because each of 5 and 6 are the most frequent numbers.

No mode

Ex.
- The values (8, 3, 9, 5, 4, 2, 10, 0) do not have a mode.

Because no value is repeated more than the others.

Important Note:
- The mode can be found for a set of categorical data.

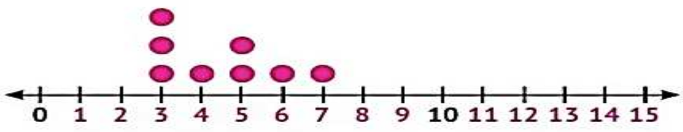
Ex. The mode of the values (red, green, yellow, red, blue) is red

Outliers

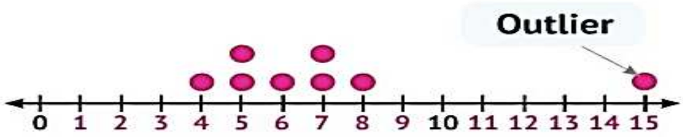
- An outlier is an extreme value (high or low) that differs from most other values.

Ex.

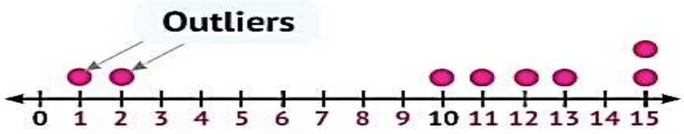
ⓐ
- Values: "6, 3, 7, 5, 3, 5, 4, 3"
- There are **no** outliers.
- Because all values are close to each other.



ⓑ
- Values: "7, 6, 5, 8, 7, 4, 15, 5"
- "15" is called an **outlier**.
- Because it is much higher than the other values.



ⓒ
- Values: "12, 15, 2, 1, 10, 15, 13, 11"
- "1 and 2" are called **outliers**.
- Because they are less than the other values.



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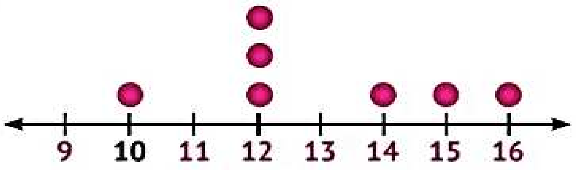
Mean, median, and outliers

Note the following examples to see the effect of outliers when calculating the mean and median of a set of values.

Ex. Set of values: "10, 12, 12, 15, 12, 16, 14"

The mean is 13

and the median is 12.



In the previous example

- If the value 16 is replaced by another value, such as 56, then the set of values becomes: "10, 12, 12, 15, 12, 58, 14".

So, the mean: 19 and the median: 12

- If the value 10 is replaced by another value, such as 3, then the set of values becomes: "3, 12, 12, 15, 12, 16, 14".

So, the mean: 12 and the median: 12

Important Notes:

The mean **is affected by** outliers in the data set.

The mean
- increases if the outliers are greater than the other values.
- decreases if the outliers are less than the other values.

The median **is not affected by** outliers in the data set.

It is preferable to use:

- The median as a measure of the central tendency if the data has outliers at one side only.
- The mean as a measure of the central tendency if the data does not have outliers.

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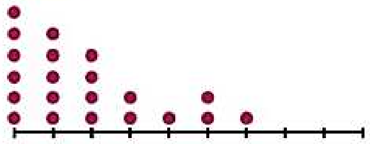
When representing data graphically using a dot plot:

If the graph is

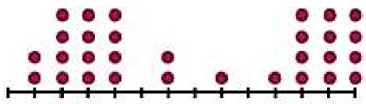
- skewed to one side, the median is the best choice as a measure of central tendency.

Ex.



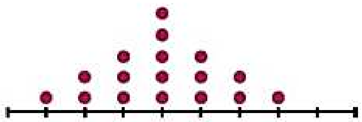
- evenly distributed, the mean is the best choice as a measure of central tendency.

Ex.



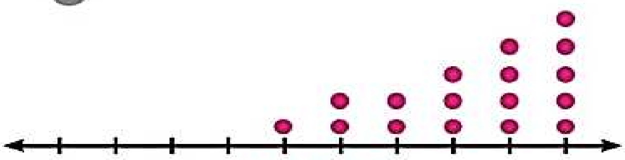
- symmetrical, then either the mean or the median are suitable as measures of central tendency.

Ex.



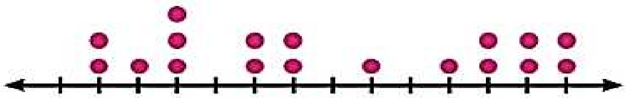
Choose the measure of central tendency that you think would be best used for each of the following graphs, (Mean, Median or Either):

ⓐ



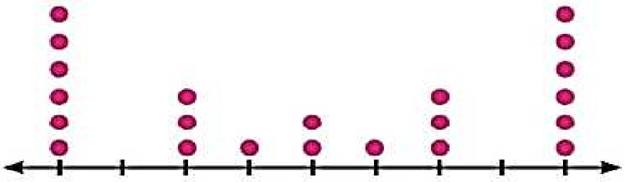
..............Median............

ⓑ



..............Mean.................

ⓒ



..................Either..........

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Exercises on lesson 3

1 Find the mode for each of the following set of values:

	Values	Mode
a	6, 7, 8, 6, 5	....
b	9, 5, 5, 9, 7, 3	....
c	4, 9, 1, 0, 8	....
d	9, 3, 2, 9, 3, 9, 7	....
e	12, 18, 19, 22, 12, 12	....
f	10, 19, 17, 16, 15	....
g	1, 2, 8, 9, 1, 3, 1	....
h	3, 0, 8, 2, 9, 30	....
i	3, 3, 5, 3, 6, 6, 6	....
j	4, 14, 24, 42, 41, 44	....

2 List the outliers in each of the following values:

	Values	Outliers
a	6, 8, 28, 7, 5	....
b	25, 30, 27, 2, 29	....
c	24, 24, 200, 25, 26	....
d	45, 52, 63, 4, 59	....
e	25, 24, 25, 26, 24, 26	....
f	142, 125, 130, 135	....
g	11, 9, 10, 50, 12, 9, 51	....
h	63, 75, 219, 56, 72, 220	....
i	0, 3, 6, 7, 5, 1, 6	....
j	100 , 150 , 50 , 200 , 100 , 150	....

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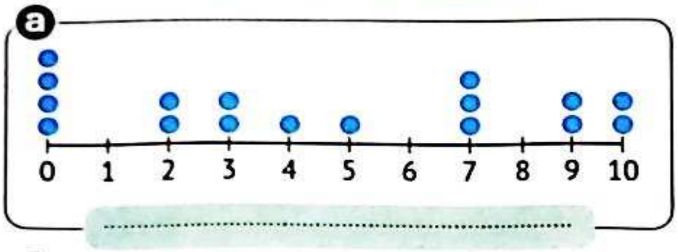
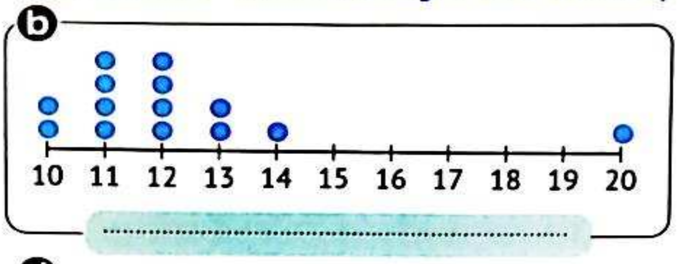
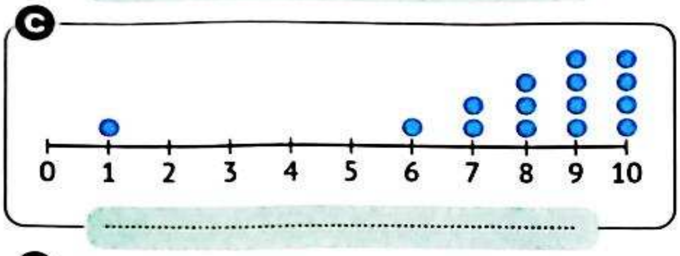
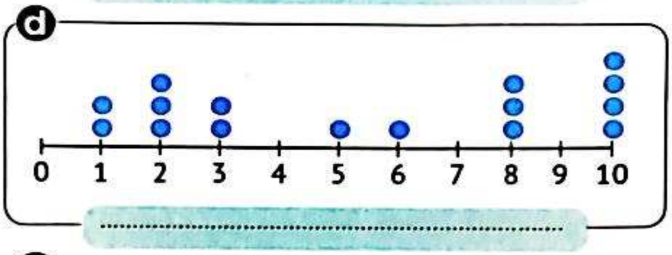
3 Choose the correct description that applies to each graph below.

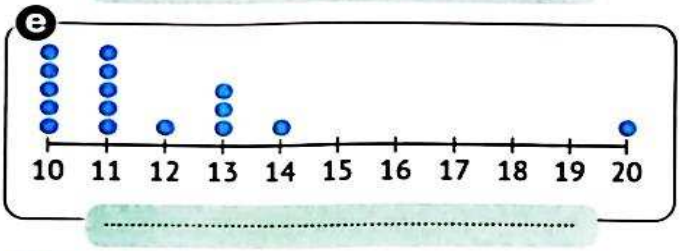
(Mean increases - Mean decreases - Mean stays the same)

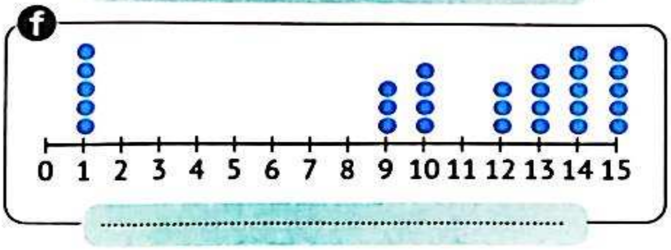




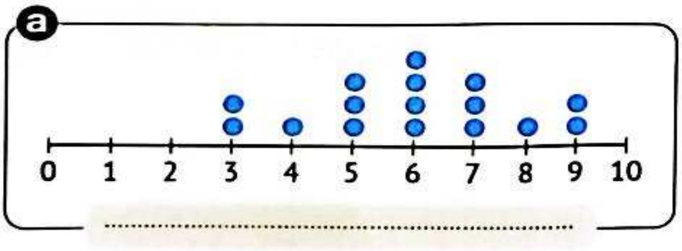


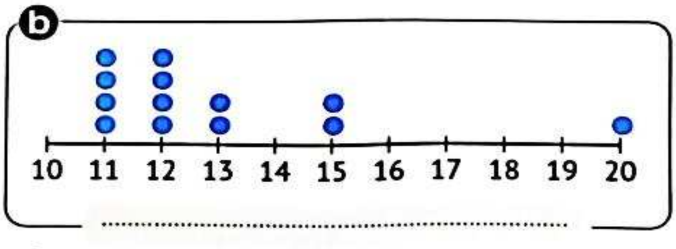


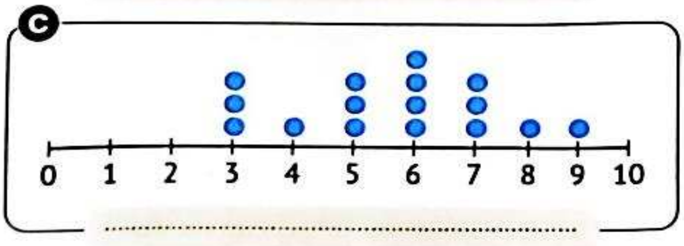


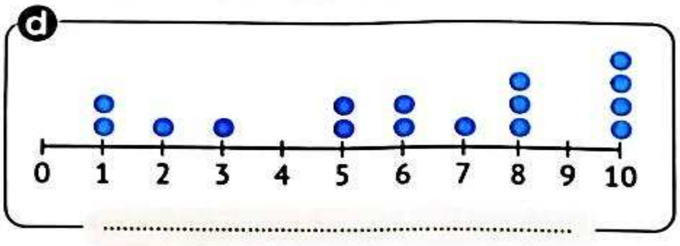


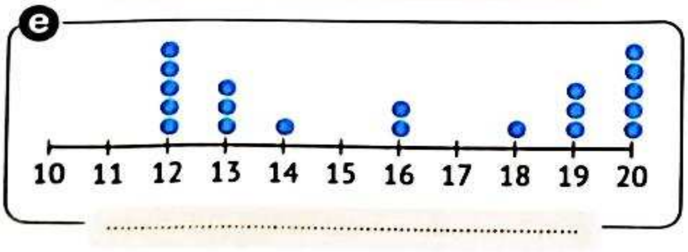
4 For each of the following data representation charts, choose the measure of central tendency that you think would be best used, mean or median or both of them.

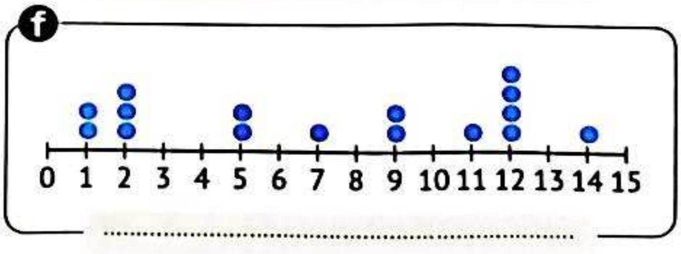












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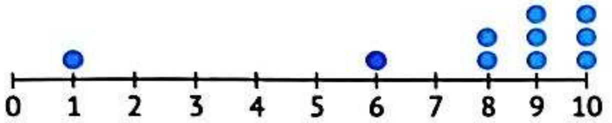
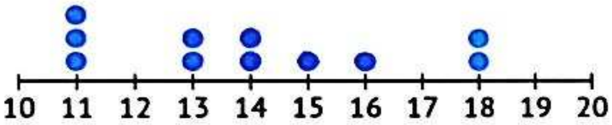
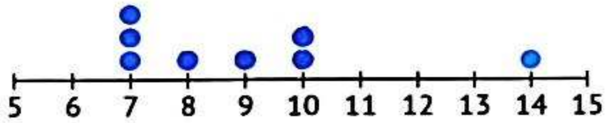
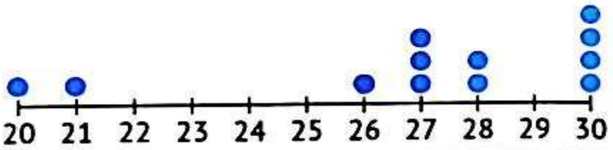
5 Complete the following table using the dot plot graph for each of the following,

	Graph	Mean	Median	Mode	Outliers
a					
b					
c					
d					

6 Complete the following:

a The mode of a set of data is .... in that set.

b The mode of the values (9, 2, 6, 7, 2, 8) is ....

c The outlier in the set of values (9, 8, 7, 25, 6) is ....

d The mean increases if the outliers are .... than the other values.

e The mean is .... if the outliers are less than the other values.

f The mean is .... by the outliers in the data set.

g The median is .... by the outliers in the data set.

h If the graph is skewed to one side, then .... will be the best choice as a measure of the center.

i If the graph is evenly distributed, then .... will be the best choice as a measure of the center.

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Quiz

/ 10

1 Choose the correct answer for the values (2, 6, 7, 23, 2, 1, 8):

ⓐ The mode: .... (6 or 7 or 2 or 23)

ⓑ The median: .... (6 or 7 or 2 or 23)

ⓒ The mean: .... (6 or 7 or 2 or 23)

ⓓ The outlier: .... (6 or 7 or 2 or 23)

(45 or 14 or 4 or 95)

---

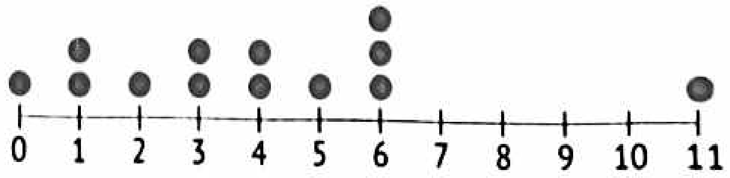
2 Using the following dot plot, complete:

ⓐ The mode: ....

ⓑ The median: ....

ⓒ The mean: ....

ⓓ The outlier: ....



ⓔ The measure of center that you think would be best used for this graph is .... (mean or median)

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Unit 7 Lesson 4

Exploring the Range

Explaining

- **Measure of variability:** it's a single value that indicates the spread of data in a set.

- **The range** of the data is the amount of spread among all the data collected.

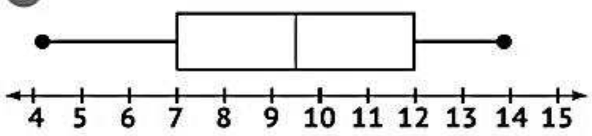
The Range = The Maximum Value – The Minimum Value

Ex. The range for the set of values "6, 3, 7, 2, 9, 5" is $9 - 2 = 7$.

Important Notes:

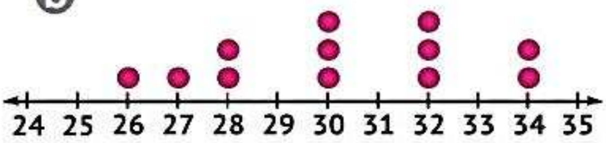
- **It is easier to find the range using a dot plot or box plot.**
  Because each of them shows the greatest value and the least value.

Ex. ⓐ



Range = 14 – 4 = 10

ⓑ



Range = 34 – 26 = 8

- **The histogram** does not show individual data points, and the data is aggregated into intervals. Therefore, the range cannot be found using a histogram.
- **The tables** can be trickier because the values are not ordered from smallest to largest.

Ex. **The following table shows Nour's scores in quizzes. What is the range score for her quizzes?**

Quiz	1	2	3	4	5	6	7	8
Scores	18	15	17	20	18	19	18	15

- **Lowest score:** 15
- **Highest score:** 20
- **The range:** 20 – 15 = 5

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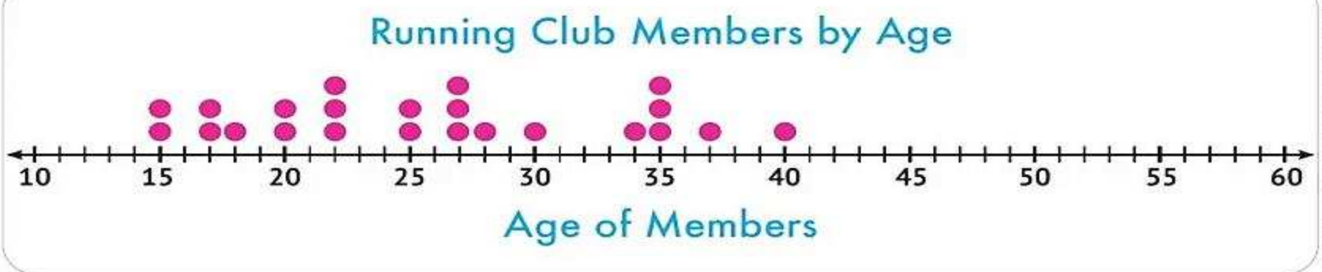
Outliers and Range

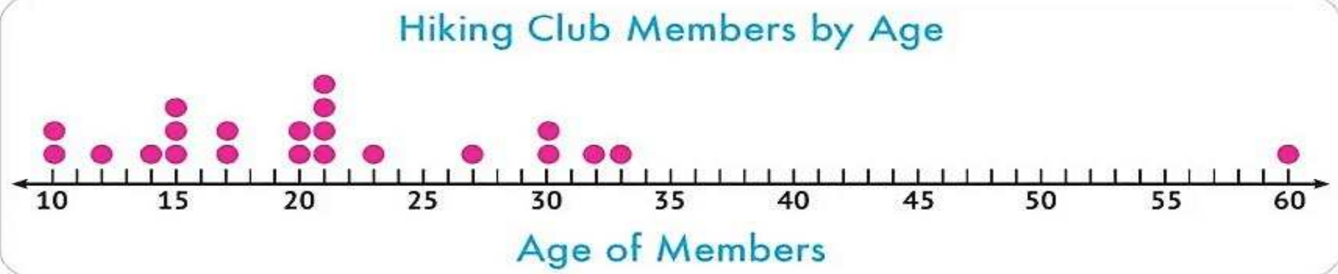
The range **is affected by** outliers in the data set.

- Therefore, it is useful to know the measures of dispersion (range) in addition to the measures of the central tendency (median) when analyzing data in which there are outliers.

Ex. **This is the comparison of the two dot plots showing the ages of members in a running club versus the members of a hiking club:**



- **Range:** 40 – 15 = 25
- **Median:** 25
- **Note that** the range accurately describes the data and that the age range is 25.



- **Range:** 60 - 10 = 50
- **Median:** 20.5
- An outlier results in a larger range, but the majority of members have a shorter life span if the outlier is excluded.

So the range is a good measure for the data when there are no outliers.

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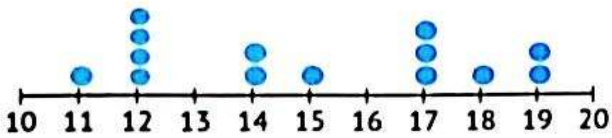
Exercises on lesson 4

1 Find the range for each of the following set of values:

	Values	Range
a	45, 25, 13, 30, 35	....
b	11, 45, 17, 25, 13	....
c	6, 2, 7, 7, 5, 3	....
d	9, 2, 7, 6, 3, 4, 9	....
e	15, 36, 70, 25, 12	....
f	7, 9, 2, 7, 2, 7, 2, 5	....
g	66, 25, 66, 15, 66	....

2 Find the range using each of the following dot plot graphs:

a

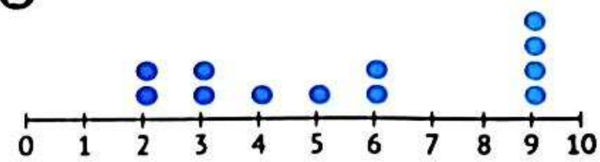


Least value: ....

Largest value: ....

Range: ....

b

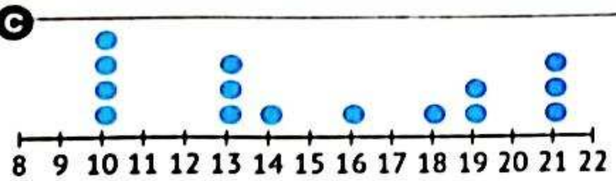


Least value: ....

Largest value: ....

Range: ....

c

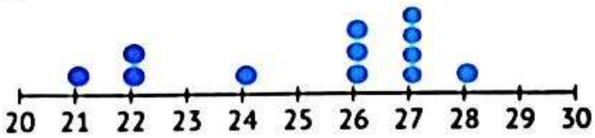


Least value: ....

Largest value: ....

Range: ....

d

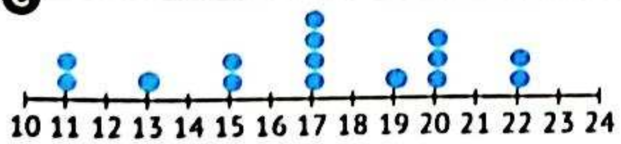


Least value: ....

Largest value: ....

Range: ....

e

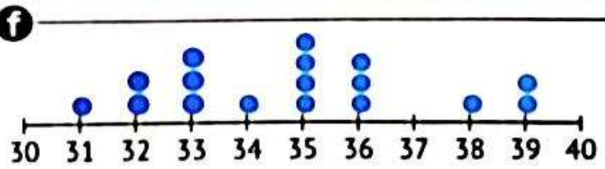


Least value: ....

Largest value: ....

Range: ....

f



Least value: ....

Largest value: ....

Range: ....

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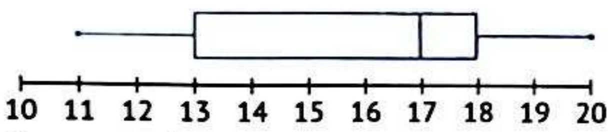
3 Find the range using each of the following box plot:

a

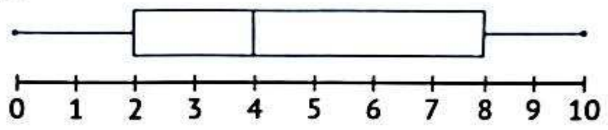


Largest value: ....

Least value: ....

The range = ...

b

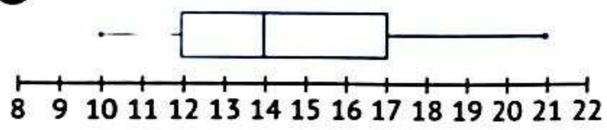


Largest value: ....

Least value: ....

The range = ...

c

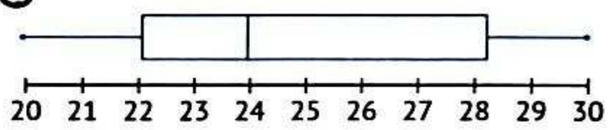


Largest value: ....

Least value: ....

Range: ....

d

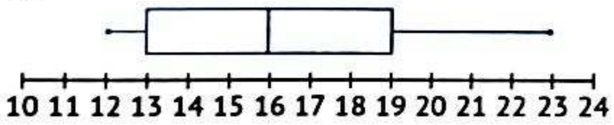


Largest value: ....

Least value: ....

Range: ....

e

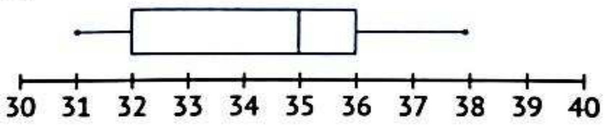


Largest value: ....

Least value: ....

Range: ....

f



Largest value: ....

Least value: ....

Range: ....

4 Find the range in each of the following:

a The following table shows the ages of a group of friends:

Name	Majed	Tawfiq	Rami	Malik	Mahmoud
Ages	15	11	18	13	14

Largest value: .... Least value: .... Range: ....

b The following table shows the amounts saved by Lamia over the past 5 months:

Month	First	Second	Third	Fourth	Fifth
The amount in pounds	120	135	200	85	115

Largest value: .... Least value: .... Range: ....

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ⓒ The following table shows the number of visitors to an exhibition for 5 days:

Day	Sunday	Monday	Tuesday	Wednesday	Thursday
Number of visitors	1,200	2,000	3,400	3,000	3,600

Least value: .... Largest value: ....

Range: ....

ⓓ The following table shows the number of students in each class in a school:

Class	First	Second	Third	Fourth	Fifth	Sixth
Number of students	280	275	250	260	224	215

Least value: .... Largest value: ....

Range: ....

5 Complete the following

ⓐ Range = ... – ....

ⓑ It is easier to find the range using a .... or ....

ⓒ The range cannot be found using ....

ⓓ The range for the values "9, 2, 4, 1, 8, 5" is ....

ⓔ If the largest value is 15, and the least value is 3, then the range = ...

ⓕ If the range of a set of values is 12 and the smallest value is 5, then the largest value is ....

ⓖ If the range of a set of values is 25 and the largest value is 52, then the smallest value is ....

ⓗ Range .... by outliers in the data set (affected, unaffected).

ⓘ It is easier to find the range using a dot plot or box plot because each of them explains ....

ⓙ The range is a measure of ....

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Quiz

/ 10

1 Choose the correct answer for the values (12, 16, 2, 15, 12, 14, 13):

ⓐ The range: .... (12 or 2 or 13 or 14)

ⓑ The mode: .... (12 or 2 or 13 or 14)

ⓒ The median: .... (12 or 2 or 13 or 14)

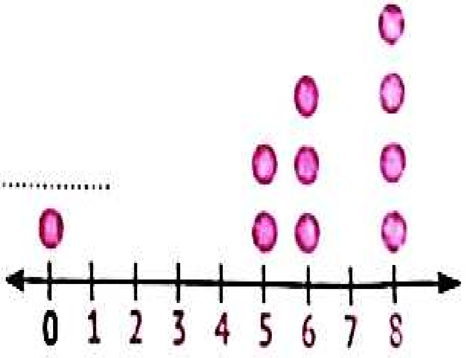
ⓓ The mean: .... (12 or 2 or 13 or 14)

ⓔ The outlier: .... (12 or 2 or 13 or 14)

2 Use the opposite box plot to complete:

ⓐ The range: .... ⓑ The median: ....

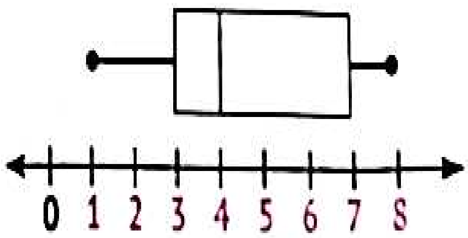
ⓒ The outlier: ....



3 Use the opposite dot plot to complete:

ⓐ The range: ....

ⓑ The median: ....



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Guide Answers

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Unit 1

Lesson 1

1 a 8 , 4 , not divisible
b 8 , 3 , not divisible
c 4 , 0 , divisible
d 30 , 0 , divisible
e 5 , 4 , not divisible
f 3 , 0 , divisible

2 30 , 54 , 258 , 212 , 654 , 26 , 368 , 6,530

3 45 , 36 , 456 1,002 , 558 , 10,002

4 45 , 250 , 830 , 945 , 630 , 2005

5 a 342 , 250 , 702 , 600
b 342 , 531 , 315 , 702 , 600
c 335 , 250 , 315 , 600
d 342 , 702 , 600
e 250 , 600

6 a ✓ , ✗ , ✓ , ✗ , ✗ , ✗
b ✓ , ✓ , ✓ , ✗ , ✓ , ✗
c ✓ , ✓ , ✗ , ✓ , ✓ , ✓
d ✓ , ✓ , ✗ , ✗ , ✓ , ✗
e ✓ , ✗ , ✗ , ✓ , ✗ , ✓
f ✓ , ✓ , ✓ , ✓ , ✓ , ✓
g ✓ , ✓ , ✓ , ✗ , ✓ , ✗

7 [a] 3 [b] 2 [c] 6
[d] 6 [e] 3 [f] 3
[g] both 2 and 5 [h] 2 , 3 and 5
[i] 4 125 [j] 750 [k] 9

Quiz

1	B	6	A
2	A	7	D
3	B	8	C
4	B	9	C
5	A	10	B

Lesson 2

1 a 16 = 2 x 2 x 2 x 2
b 20 = 2 x 2 x 5
c 36 = 2 x 2 x 3 x 3
d 48 = 2 x 2 x 2 x 2 x 3

2 a 16 = 2 x 2 x 2 x 2 , 20 = 2 x 2 x 5
GCF = 2 x 2 = 4
LCM = 2 x 2 x 2 x 2 x 5 = 80
b 24 = 2 x 2 x 2 x 3 , 36 = 2 x 2 x 3 x 3
GCF = 2 x 2 x 3 = 12
LCM = 2 x 2 x 2 x 3 x 3 = 72
c 16 = 2 x 2 x 2 x 2 , 15 = 3 x 5
GCF = 1
LCM = 2 x 2 x 2 x 2 x 3 x 5 = 240

3 a 9 = 3 x 3
8 = 2 x 2 x 2
GCF = 1 LCM = 72 (Yes)
b 15 = 3 x 5 4 = 2 x 2
GCF = 1 LCM = 60 (Yes)
c 6 = 2 x 3 8 = 2 x 2 x 2
GCF = 2 LCM = 24 (No)

4 a The two numbers are 30 and 20
b common prime factors are 2 , 5
c GCF = 10 d LCM = 60 e NO

Quiz

1. C 2. B 3. D
4. A 5. A 6. B
7. D 8. D 9. C
10. D

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Lesson 3

1. (a) 5 , 3 , 5 , 6 (b) 7 , 2 , 4
   (c) 9 , 2 , 8 , 8 (d) 9 , 4 , 6
2. (a) 6 (b) $30 \div 6 = 5$
   (c) $48 \div 6 = 8$
   (d) $(6 \times 5) + (6 \times 8) = 6 \times (5 + 8)$
3. $(8 \times 3) + (8 \times 2) = 8 \times (3 + 2)$

Quiz

1. (a) 7,5 (b) 4,6,2,2
   (c) 3 (d) 1 (e) 6 , 8
2. (a) GCF = 3, the greatest number of groups is 3
   (b) GCF = 4
   $(4 \times 3) + (4 \times 2) = 4 \times (3 + 2)$

Lesson 4

1. (a) $\frac{9}{12} + \frac{5}{12} = \frac{14}{12} = \frac{7}{6} = 1\frac{1}{6}$
   (b) $\frac{7}{9} - \frac{3}{9} = \frac{4}{9}$
   (c) $2\frac{9}{24} + 1\frac{20}{24} = 3\frac{29}{24} = 4\frac{5}{24}$
   (d) $5\frac{16}{18} - 3\frac{9}{18} = 2\frac{7}{18}$
   (e) $8\frac{3}{15} + 2\frac{5}{15} = 10\frac{8}{15}$
   (f) $6\frac{8}{12} - 2\frac{3}{12} = 4\frac{5}{12}$
2. (a) $2\frac{3}{4} + 1\frac{1}{2} + 1\frac{1}{5}$
   $= 2\frac{15}{20} + 1\frac{10}{20} + 1\frac{4}{20}$
   $= 4\frac{29}{20} = 5\frac{9}{20}$ hours
   (b) $5\frac{1}{2} + 3\frac{3}{4} + 2 = 5\frac{2}{4} + 3\frac{3}{4} + 2$
   $= 10\frac{5}{4} = 11\frac{1}{4}$ pounds
   (c) $25\frac{1}{2} - 16\frac{1}{4} = 25\frac{2}{4} - 16\frac{1}{4}$
   $= 9\frac{1}{4}$ pounds
   (d) $4\frac{1}{2} - 3\frac{1}{4} = 4\frac{2}{4} - 3\frac{1}{4}$
   $= 1\frac{1}{4}$ hours

Quiz

1. (a) $5\frac{1}{6} + 3\frac{2}{6} = 8\frac{3}{6} = 8\frac{1}{2}$
   (b) $9\frac{2}{4} - 2\frac{1}{4} = 7\frac{1}{4}$
   (c) $7\frac{3}{4} - 3\frac{2}{5} = 7\frac{15}{20} - 3\frac{8}{20} = 4\frac{7}{20}$
   (d) $7\frac{1}{3} + 3\frac{4}{5} = 7\frac{5}{15} + 3\frac{12}{15} = 10\frac{17}{15}$
   $= 11\frac{2}{15}$
2. (a) The total mass $= 3\frac{1}{2} + 4\frac{1}{4}$
   $= 3\frac{2}{4} + 4\frac{1}{4} = 7\frac{3}{4}$ kg
   (b) she has left $= 12 - 3\frac{1}{2} = 11\frac{2}{2} - 3\frac{1}{2}$
   $= 8\frac{1}{2}$ meters

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Unit 2

Lessons 1 & 2

1. a. Integer b. Not integer
c. Not integer d. Integer
e. Integer f. Not integer
g. Not integer h. Integer

2. a. zero , 1 b. 1 , – 1
c. zero , zero d. zero
e. – 2 , – 1 , 0 and 1
f. – 3 g. – 11
h. 6 integers.

3. a. – 12 b. – 10
c. – 6,000 d. 4
e. 3 f. 750
g. – 20 h. 7
i. 100 j. – 200

4. a. 5 b. – 6
c. 0 d. 16
e. – 1,000 f. – 4

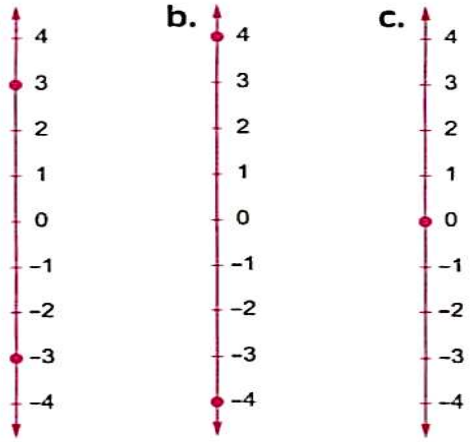
5. a. 3 , – 3 b. 5 , – 5
c. – 2 , 2 d. – 5 , 5

6. a.

b.

[You can represent the numbers on a vertical line]

7.



[You can represent the numbers on a horizontal line]

8. a. < b. > c. <
d. > e. < f. >

9. a. The order is : – 4 , – 1 , 1 , 3
b. The order is : – 9 , – 7 , – 4 , – 1
c. The order is : – 60 , – 22 , – 17 , 0 , 2 , 6

10. a. The order is : 7 , 0 , – 9 , – 15
b. The order is : 8 , 0 , – 13 , – 15 , – 19
c. The order is : 5 , 3 , 1 , – 1 , – 8 , – 11

11. a. – 3 , – 2 , – 1 , 0 , 1
b. 0 , 1 , 2 , 3 , 4

12. a. True b. Not true
c. True d. True
e. Not true

Quiz

1. a 0 b –4 c 3
2. a –7 b –4 c <
3. The order: -30,-18,0 ,3 ,11

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Lessons 3 & 4

1.
a) ✓ , ✓ , ✓ , ✓
b) ✗ , ✗ , ✓ , ✓
c) ✗ , ✓ , ✓ , ✓
d) ✗ , ✗ , ✗ , ✓
e) ✗ , ✗ , ✗ , ✓
f) ✗ , ✗ , ✗ , ✓
g) ✓ , ✓ , ✓ , ✓
h) ✗ , ✗ , ✗ , ✓
i) ✗ , ✗ , ✗ , ✓
j) ✗ , ✗ , ✓ , ✓

2. Draw by yourself.

3. $\frac{5}{2}, -\frac{4}{5}, \frac{5}{1}, -\frac{7}{2}, \frac{11}{4}$

$-2.5, 0.8, -5, 3\frac{1}{2}, -2\frac{3}{4}$

4.
a) < b) < c) <
d) < e) < f) <
g) < h) > i) >
j) = k) > l) <

5.
a) Ascending : $-5.5, -1\frac{3}{5}, 2\frac{2}{3}, 3.7, 7\frac{1}{4}$

Descending : $7\frac{1}{4}, 3.7, 2\frac{2}{3}, -1\frac{3}{5}, -5.5$

b) Ascending : $-0.82, -\frac{1}{2}, 0.25, \frac{1}{2}, \frac{2}{3}$

Descending : $\frac{2}{3}, \frac{1}{2}, 0.25, -\frac{1}{2}, -0.82$

c) Ascending : $-5.5, -5\frac{1}{4}, -5\frac{1}{5}, 2.2, 2\frac{3}{4}$

Descending : $2\frac{3}{4}, 2.2, -5\frac{1}{5}, -5\frac{1}{4}, -5.5$

6.
a) rational number
b) even number
c) natural number
d) $\frac{3}{4}$
e) $-\frac{6}{1}$
f) $-4\frac{2}{3}$
g) 0.5
h) >
i) $-\frac{8}{4}$
j) $\frac{3}{2}$

Quiz 1

1. D	2. C	3. D
4. D	5. B	6. C
7. D	8. B	9. C
10. A		

Quiz 2

1. A	2. A	3. B
4. B	5. A	6. D
7. C	8. B	9. D
10. A		

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Lessons 5 & 6

1 (a) 5 (b) 15 (c) 6
(d) 45 (e) $\frac{7}{9}$ (f) $7\frac{3}{5}$
(g) $\frac{3}{4}$ (h) $7\frac{2}{3}$ (i) 0.03
(j) 0.7 (k) 7.04 (l) 6.5

2 (a) < (b) > (c) =
(d) = (e) = (f) >
(g) > (h) > (i) >
(j) < (k) < (l) >
(m) = (n) < (o) > (p) >

3 (a) Ascending: −17 , −9 , | −3 | , 8, | 12 |

Descending: | 1 2| , 8 , | −3 | , −9 , −17

(b) Ascending: −4.8 , −2.7 , | −1.5 | , | 6.7 | , 7.3

Descending: 7.3 , | 6.7 | , | −1.5 | , −2.7 , −4.8

(c) Ascending: $-\frac{3}{4}, -\frac{5}{8}, |\frac{1}{4}|, |-\frac{1}{2}|, \frac{3}{4}$

Descending: $\frac{3}{4}, |-\frac{1}{2}|, |\frac{1}{4}|, -\frac{8}{5}, -\frac{2}{4}$

4 (a) 5 or -5 (b) 7 (c) 9
(d) −5 (e) −4 (f) 18
(g) Moscow, < (h) A (i) −7.2

5 (a) ① Wael , Tamer and Mohamed
② Tariq, Sameh and Fouad
③ Fouad
④ Tariq

(b) Tamer, Wael , Mohamed , Fouad , Sameh , Tariq

Quiz

1. A	2. A	3. A
4. A	5. D	6. A
7. B	8. B	9. A
10. B		

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Unit 3

Lessons 1&2

Creating Expressions

Analyzing Expressions

1 a) 2, 3, m b) 2, −5, y c) 3, $\frac{1}{3}$, a, b
d) 2, $-\frac{3}{7}$, n e) 4, 6, x, y, z

2 a) Numerical b) Algebraic c) Numerical
d) Algebraic e) Algebraic

3 a) a / 7 / 2,4 b) x / 5,17 / 1 c) y / $\frac{1}{5}$, 22 / 2
e) q, r, s / Non / 8 / Non / 0.2, 0.6, 0.8
f) Non / 8 / Non

4 a) 3 / x, $\frac{3}{8}$x b) 4 / m, 2 m, 3, 2
c) 2 / 16 x, 2 x d) 4 / 7x, 2 x, 7x

5 a) 12 – d b) x + 3
c) $\frac{1}{5}$w d) x + 10

6 a) 2 b) -3 c) a
d) 3 e) 2 f) 5y, 2y
g) none h) 9 i) 5,3
j) m – 10

Quiz

1. C 2. B 3. D
4. A 5. B 6. D
7. D 8. C 9. C
10. B

Lessons 3

1 a) 36 + z b) x − 5 c) a + 9
d) 3b e) 7.5p f) y − 14
g) h + 6 h) 9 + r i) a + 3.5
j) $\frac{1}{2}$q + 4 k) 2w − 7 l) 2v − 3
m) 2 (g + 6) n) 3 (s − 2) o) 3a + 5
p) x + 7 q) m + 12 r) x + 3

2 a) 9 more than a
b) 6 less than b
c) f less than 7.5
d) 12 multiplied by y
e) 8 divided by s
f) k divided by r
g) add 6 to 3 times x
h) 2 times x less than 7
i) half the sum of m and 3
j) 5 times 3 less than c

3 a) x – 5 b) x + 10 c) 2 x − 3
d) 3y − 2 e) 3 (m + 12) f) $\frac{1}{2}$(a − 7)
g) x + 5 h) x, +

4 a) 3 b) 1 c) 4 d) 2

Quiz

1 a) x decreased by 2
b) The sum of 7 and 5 times a
c) Double y subtracted from 3.6

2 a) y-3 b) 2 (x + 7) c) x, –

3 a) 4 b) 1 c) 2 d) 3

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Lesson 4

1 (a) 4 (b) 3 (c) 3
(d) 8 (e) 2^4 (f) 6^3
(g) 7 × 7 (h) 6 × 6 × 6 × 6 (i) 10 × 10
(j) 1×1×1×1×1 (k) 5 × 5 × 5 (l) 2 × 2

2 (a) 25 (b) 27 (c) 32
(d) 1 (e) 1 (f) 1000
(g) 0 (h) 0 (i) 1
(j) 1 (k) 1 (l) 1

3 (a) 34 (b) 14 (c) 12
(d) 25 (e) 10 (f) 19
(f) 9 (g) 12 (h) 22

4 (a) 18 (b) 3 (c) 24
(d) 5 (e) 10

5 (a) 22 (b) 7 (c) 20
(d) 9 (e) 3 (f) 3
(g) 2 (h) 3 (i) 215
(j) 2 (k) 9 (l) 74

6 (a) 32 (b) 5 (c) 3 (d) 76

7 (a) 4 × 4 (b) 1 (c) 1
(d) 2^5 (e) 5^3 (f) 0
(g) 1 (h) 3 × 3 × 3 × 3 (i) =
(j) > (k) 19 (l) 800 (m) 3^3

8 (a) base , power (b) base , power
(c) 4^2 (d) 8^3 (e) 6^3
(f) 7^2 (g) 4^5 (h) 6 , 4
(i) 4 (j) 4

Quiz

1 (a) 27 (b) 12 (c) 24
(d) 3 (e) (32 + 3) + (8 – 1) = 35 + 7 = 5

2 (a) 4 × 4 × 4 (b) 2 (c) >
(d) 2^4 (e) 1

Lessons 5-7

1 (a) 8x (b) 12y (c) 7z
(d) 50m + 15 (e) 6n + 3 (f) 300 – 9p
(g) 3a + 6

2 (a) 33 (b) 1 (c) 3.9
(d) 5 (e) 3 (f) 3

3 (a) 34 (b) 21 (c) 11
(d) 21 (e) 7 (f) 4
(g) 21 (h) 0

4 (a) 11 (b) 22 (c) 2 (d) 12

5 (a) 10 + 5h (b) 35 pounds

6 (a) 10p – 325 (b) 175 pounds

7 (a) Not equivalent (b) Equivalent
(c) Not equivalent (d) Equivalent
(e) Not equivalent

Quiz

1 (a) 9k (b) 7z (c) 14 (d) 2

2 (a) 2 (b) 3 (c) 1

3 (a) 6 (b) 2 (c) 6

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Unit 4

Lesson 1

1. a. Equation: $3x = 6$

Solution:

$\frac{3x}{3} = \frac{6}{3}$ | or $x = 6 \div 3$

$x = 2$ | $x = 2$

b. Equation: $4x = 12$

Solution:

$\frac{4x}{4} = \frac{12}{4}$ | or $x = 12 \div 4$

$x = 3$ | $x = 3$

c. Equation: $x + 2 = 7$

Solution:

$x + 2 - 2 = 7 - 2$ | or $x = 7 - 2$

$x = 5$ | $x = 5$

d. Equation: $x + 3 = 5$

Solution:

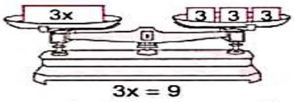
$x + 3 - 3 = 5 - 3$ | or $x = 5 - 3$

$x = 2$ | $x = 2$

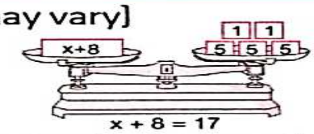
2. a. $x = 12 - 3$, $x = 9$
b. $x = 15 - 8$, $x = 7$
c. $x = 25 + 7$, $x = 32$
d. $y = 7 + 5$, $y = 12$
e. $z = 8 - 8$, $z = 0$
f. $y = 44 - 9$, $y = 35$
g. $x = 27 \div 3$, $x = 9$
h. $x = 16 \div 4$, $x = 4$
i. $y = 37 \div 37$, $y = 1$
j. $a = 0 \div 5$, $a = 0$
k. $x = 12 \times 6$, $x = 72$
l. $y = 1 \times 5$, $y = 5$
m. $t = 70 - 50$, $t = 20$
n. $n = 16 + 3$, $n = 19$
o. $y = 48 \div 4$, $y = 12$

3. a. 6　b. 15　c. 15
d. 7　e. 28　f. 4
g. 24　h. 7　i. 10
j. one　k. 5　l. $2\frac{1}{2}$
m. $\frac{4}{9}$

4. a. (Answers may vary)



$3x = 9$



$x + 8 = 17$

b. by removing 3 units from each side of the balance.
$x = 12 - 3$, $x = 9$

c. $x = 18 \div 6$, $x = 3$

5. a. $4x = 16$
we write the expression of each side of the balance and write equal between them.

b. $x = 16 \div 4$ | or $\frac{4x}{4} = \frac{16}{4}$

$x = 4$ | $x = 4$

Check the answer: $4 \times 4 = 16$

Quiz

1. a. $x + 2 - 2 = 11 - 2$, $x = 9$
b. $m - 7 + 7 = 9 + 7$, $m = 16$
c. $5y + 5 = 45 + 5$, $y = 9$
d. $\frac{k}{8} \times 8 = 6 \times 8$, $k = 48$

2. a. 18　b. 6　c. 9

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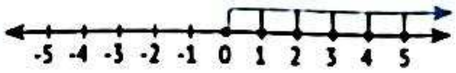
Lessons 2&3

1 (a) x > -1 (b) x < 2 (c) x > -9
(d) x < 2 (e) x ≥ 6 (f) x ≤ -8
(g) x ≤ 4 (h) x ≥ -2 (i) x < 0
(j) x > 0 (k) x ≥ 0 (l) x > 0
(m) x ≥ 0 (n) x ≤ 0

2 (a) more than 9 (b) more than -5
(c) less than 2 (d) less than -7
(e) less than or equal to -3
(f) less than or equal to 4
(g) more than or equal to 3
(h) more than or equal to 0

3 (a)

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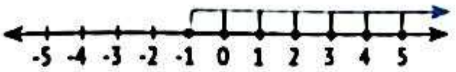
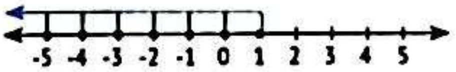

(c)

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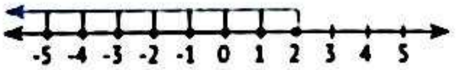
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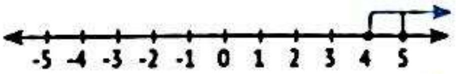
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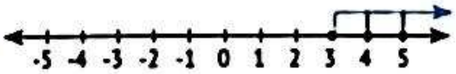
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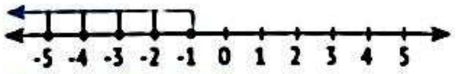
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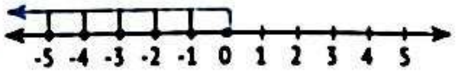

4 (a) x > -1 (b) x < 5 (c) x ≤ -7
(d) x ≥ 3 (e) x < 0 (f) x ≤ 0
(g) 3 does not belong to the solution set on and of then
(h) each including all values to the left of 4
(i) -9.5 (j) 6 (k) x ≤ 7

5 (a) (1) both of them include numbers to the left of -8 on the number line.
(2) -8 does not belong to the solution set of the inequality "x < -8" and -8 does not belong to the solution set of the inequality "x < -8"b.
(b) (1) -8 does not belong to the solution set of the inequality of any of them.
(2) x ≥ -8 has all numbers to the right of -8 and x ≤ -8 has all numbers to the left of -8.
(c) (1) non algebraic.
(2) -8 is the solution of "x = -8" and -8 does not belong to the solution set of the inequality "x < -8".

6 (a) x < 3 (b) x > -1 (c) x > 2
(d) x > 2 (e) x > -6 (f) x < 5

Quiz

1. D 2. C 3. B
4. D 5. A 6. D
7. C 8. C 9. D
10. D

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Unit 5

Lessons 1&2

1
- a. Dependent , Independent
- b. Independent , Dependent
- c. Dependent , Independent
- d. Dependent , Independent
- e. Independent , Dependent
- f. Independent , Dependent
- g. Independent , Dependent
- h. Independent , Dependent
- i. Independent , Dependent

2
- a. Independent : r,s,z,x Dependent: e,b,m,y
- b. Independent : a,t,p,m Dependent: b,f,z,w

3
- a. $y = 9x$ b. x
- c. y d. 54

4
- a. $y = x + 15$ b. x
- c. y d. 135

5
- a. $y = x - 50$ b. x
- c. y d. 370

6
- a. $y = x \div 3$ b. x
- c. y d. 140 , 120 , 90 , 70 , 60

Quiz

1. A 2. B 3. C
4. A 5. C 6. D
7. B 8. D

Lessons 3&4

1.

a. $y = 2(2) = 4$

b. $y = 2 + 3 = 5$

c. $y = 2 + \frac{1}{4} = 2\frac{1}{4}$

d. $y = 2 + 8.5 = 10.5$

e. $y = 4(2) + 5 = 8 + 5 = 13$

f. $y = 2(2) + \frac{3}{4} = 4 + \frac{3}{4} = 4\frac{3}{4}$

g. $y = 5(2) + 35 = 10 + 35 = 45$

h. $y = 7(2) + 7.19 = 14 + 7.19 = 21.19$

2.

a. $y = 5x$, $y = 5(7) = 35$

b. $y = x + 1$, $y = 5.2 + 1 = 6.2$

c. $y = 4x + 3$

, $y = 4(3.3) + 3 = 13.2 + 3 = 16.2$

d. $y = 5x + 4.1$

, $y = 5(8) + 4.1 = 40 + 4.1 = 44.1$

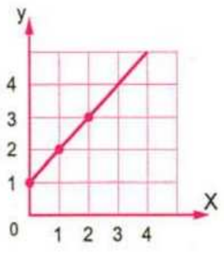
3.

- (A) $y = 2x$, (B) $y = 2(2.3) = 4.6$
- (C) $y = x + 6$, (D) $y = \frac{1}{4} + 6 = 6\frac{1}{4}$

4.

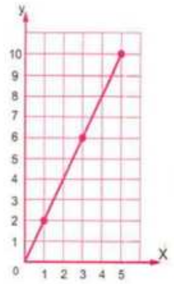
a.

x	0	1	2
y	1	2	3
(x , y)	(0 , 1)	(1 , 2)	(2 , 3)



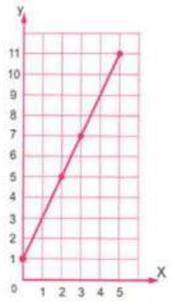
b.

x	1	3	5
y	2	6	10
(x , y)	(1,2)	(3,6)	(5,10)



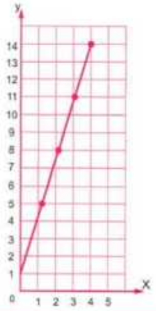
c.

x	0	2	3	5
y	1	5	7	11
(x , y)	(0,1)	(2,5)	(3,7)	(5,11)



d.

x	1	2	3	4
y	5	8	11	14
(x , y)	(1,5)	(2,8)	(3,11)	(4,14)



5.

a. $y = x + 4$

b. $y = \frac{1}{2}x + 1$

Quiz

1. D 2. C 3. D
4. B 5. D 6. A
7. B 8. C 9. D
10. B

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Unit 6

Lesson 1

1.
- a) None
- b) Statistical
- c) None
- d) None
- e) None
- f) None
- g) Statistical
- h) None
- i) Statistical
- j) Statistical

2.
- a) Numerical
- b) Categorical
- c) Categorical
- d) Numerical
- e) Numerical
- f) Numerical
- g) Categorical
- h) Numerical
- i) Numerical
- j) Categorical

3.
- a) Statistical , Non-statistical
- b) Numerical , Categorical
- c) Numerical
- d) Categorical
- e) Non-statistical , Statistical
- f) Non-statistical , Statistical
- g) Numerical
- h) Numerical
- i) Categorical
- j) Categorical/numerical

4.
- a) result in a lot of different answer
- b) favorite color
- c) favorite TV show
- d) ages
- e) salaries
- f) weights
- g) heights
- h) names
- i) types of pets

Quiz

1.
- a) Numerical/ Categorical
- b) Numerical/ Categorical
- c) numbers
- d) adjectives or word
- e) Statistical

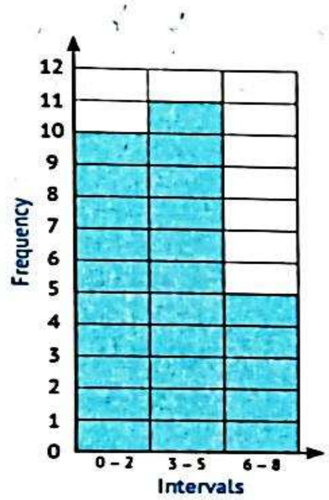
2.
- a) Favorite colors
- b) Salaries
- c) lengths
- d) types of pets
- e) non-statistical

Lessons 2&3

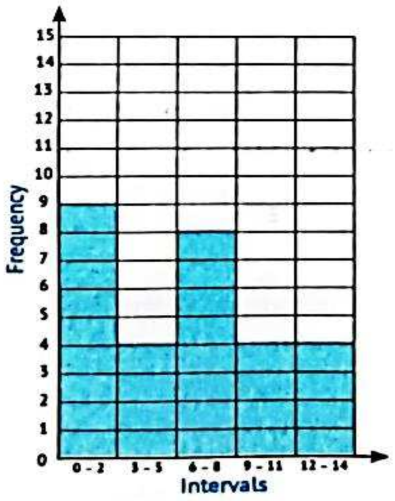
1.
- a) bar graph
- b) histogram
- c) bar graph
- d) dot plots
- e) histogram
- f) histogram
- g) bar graph
- h) dot plots
- i) dot plots
- j) histogram
- k) histogram

2. 8,14,6,18,10

3. 10 ,11,5



4. 9 , 4 , 8 , 4 , 4



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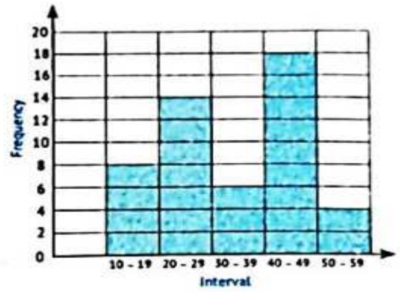
5



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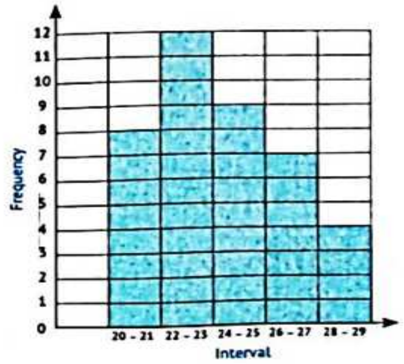

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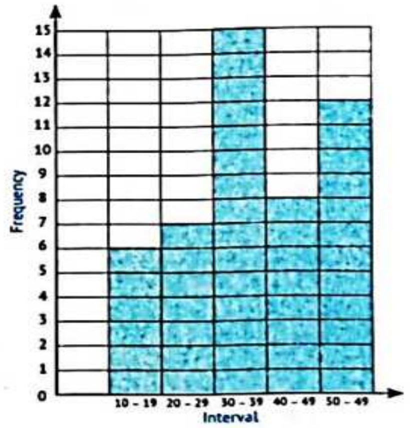


8 a histogram b dot plots
c bar graph d all
e each information is rep···sent by a point
f each bar represent a number or one categorical,
g the bars must touch
h bars are used to represent data
i both of bar graph and histogram
j all

Quiz

1 a 2 b 3 c 1

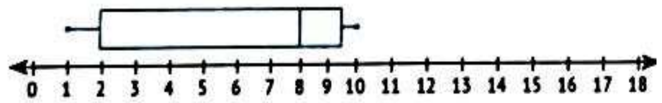
2 6/6/7/10/2

Lesson 4

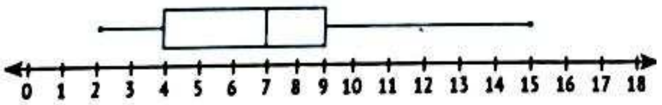
1 a the central tendency b 6 c 6
d 3 e 6 f 2,7

2 a ① 2 ② 4 ③ 10 ④ 15 ⑤ 18
b ① 1 ② 3 ③ 12 ④ 14 ⑤ 16
c ① 4 ② 5 ③ 7 ④ 13 ⑤ 15

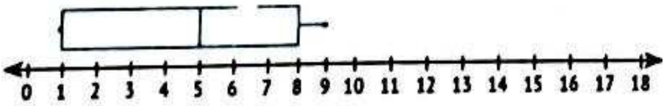
3 a ① 1 ② 2 ③ 8 ④ 9.5 ⑤ 10



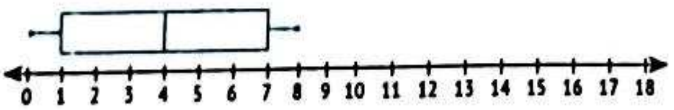
b ① 2 ② 4 ③ 7 ④ 9 ⑤ 15



c ① 1 ② 1 ③ 5 ④ 8 ⑤ 9



d ① 0 ② 1 ③ 4 ④ 7 ⑤ 8



Quiz

1 a 2 b 3 c 7
d 8 e 11

2 a 1 b 4 c 9
d 13 e 17

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Lesson 5

1.

a. Dot plot

b. Dot plot and Box plot

c. Dot plot and Box plot

d. Histogram

e. Dot plot and Box plot

f. Dot plot

g. Dot plot and Histogram

h. Box plot

i. Dot plot and Histogram

j. Histogram

k. Box plot and Histogram

2.

a. Histogram b. Box plot

c. Box plot d. Histogram

3.

a. Dot plot

b. Histogram and Dot plot

c. Dot plot d. Dot plot

Quiz

(1) (a) 3 (b) 1 (c) 2

(2) (a) (1) how many students were absent for 5 days?

(2) what is the common day number of absences?

(b) (1) what the what is the most frequency interval?

(2) what the what is the least frequency interval?

(c) (1) what is the median?

(2) what is the first quartile?

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Unit 7

Lessons 1&2

1. (a) 5 (b) 13 (c) 6 (d) 7
   (e) 15 (f) 8 (g) 15 (h) 6
   (i) 16 (j) 24
2. (a) 5 (b) 5.5 (c) 4 (d) 3
   (e) 3 (f) 50
3. 126
4. 92
5. 24
6. 2
7. 3
8. (a) 23.25 (b) 4 (c) 10 (d) 1
   (e) 8 (f) 9 (g) 48
9. (a) 7 (b) 4 (c) 24
   (d) 5 (e) 100 (f) 6

Quiz

1. (a) 50 (b) 5 (c) 6
   (d) 6 (e) 45
2. (a) 7 (b) 6

Lesson 3

1. (a) 6 (b) 5,9 (c) non
   (d) 9 (e) 12 (f) non
   (g) 1 (h) non (i) 3,6
   (j) non
2. (a) 28 (b) 2 (c) 200
   (d) 4 (e) non (f) non
   (g) 50,51 (h) 219,220 (i) non
   (j) non
3. (a) stay the same (b) increase
   (c) decrease (d) stay the same
   (e) increase (f) decrease
4. (a) both (b) median (c) mean
   (d) mean (e) both (f) mean
5. (a) 8 , 9 , 9and10 , 1
   (b) 14 , 14 , 11 , non
   (c) 9 , 8.5 , 7 , 14
   (d) 27 , 27.5 , 30 , 20and21
6. (a) the most common value (b) 2
   (c) 25 (d) more than (e) decrease
   (f) affected (g) not affected (h) median
   (i) mean

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Quiz

1. a) 2 b) 6 c) 7
   d) 23

1. a) 6 b) 4 c) 4
   d) 11 e) Median

Lesson 4

1. a) 32 b) 34 c) 5
   d) 7 e) 58 f) 7
   g) 51
2. a) 19,11,8 b) 9,2,7 c) 21,10,11
   d) 28,21,7 e) 22,11,11 f) 39,31,8
3. a) 20,11,9 b) 10,0,10 c) 21,10,11
   d) 30,20,10 e) 23,12,11 f) 38,31,7
4. a) 11,18,7 b) 85,200,115
   c) 1,200 , 3,600 , 2,400
   d) 215 , 280 , 65
5. a) maxmum - mimimum
   b) box plots or dot plots
   c) histogram d) 8 e) 12
   f) 17 g) 27 h) affected
   i) largest and smallest values
   j) dispersion

Quiz

1. a) 14 b) 12 c) 13
   d) 12 e) 2
2. a) 8 b) 6 c) 0
2. a) 8 - 1 = 7 b) 4

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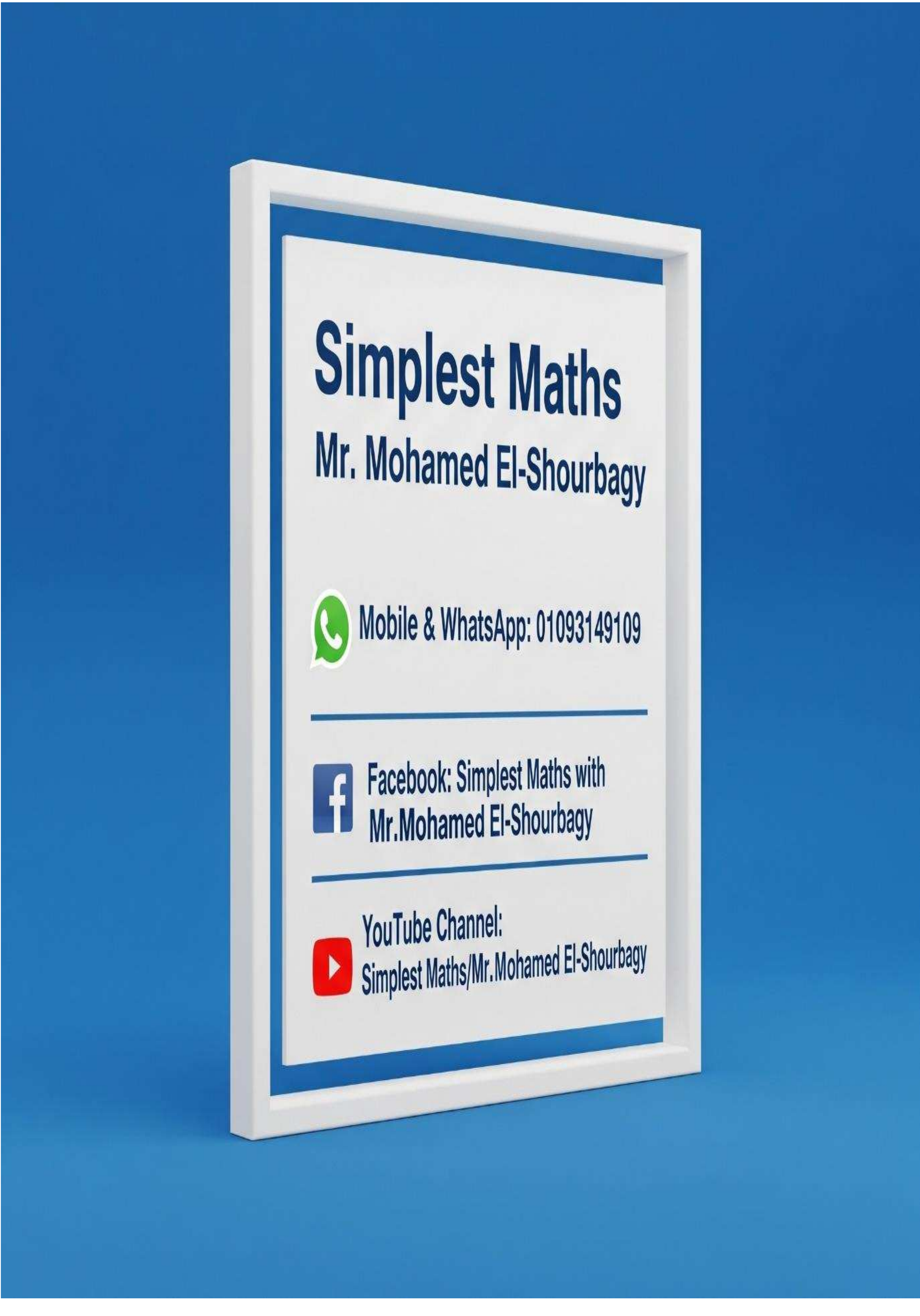

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